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SCIENCE 7

STUDENT SUPPORT GUIDE

Distance Learning

Alberta EDUCATION

Science 7

Modules 1 – 6

STUDENT SUPPORT GUIDE

Alberta
EDUCATION

Note to the Parent or Guardian

This Science 7 Student Support Guide contains answers to activities in the accompanying Module Booklets. It should be kept secure by the parent or guardian if the student is under 16 years of age. Younger students should not have access to this Guide except under supervision.

This Student Support Guide does not contain the answers to the accompanying Assignment Booklet. The Assignment Booklet will be graded by the student's distance education teacher.

Science 7
Student Support Guide
Modules 1–6
Learning Technologies Branch
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FOREWORD

Welcome to distance learning. You have chosen an alternate form of learning that allows your student greater freedom in some ways than traditional classroom learning. It also requires discipline and motivation for your student to carry on without someone standing behind and pushing as a classroom teacher often does. For junior high students distance learning is generally more effective if there is a learning facilitator. A parent or guardian of a student studying at home can be this person. As the learning facilitator, you will have to help motivate and discipline your distance learning student.

This guide has been developed to assist you. It begins by familiarizing you with the process of learning at a distance. You will learn what is expected of a learning facilitator, how the course is set up, and how to help your student complete the course successfully. The remainder of this guide and all other guides (there is one for every module) contain guidance and answers to the activities your student is expected to do. Begin by reading the introductory material in this guide.

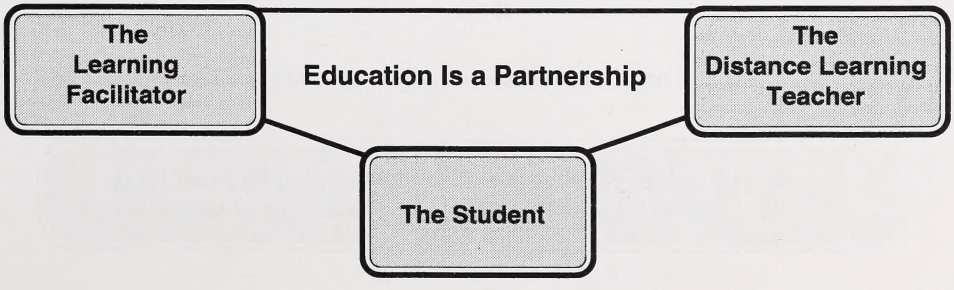
DISTANCE LEARNING

The Role of the Learning Facilitator

As the learning facilitator, you have a key role in determining the success your student has taking this course. Students need encouragement and the confidence of knowing that the course is important to their future.

You are expected to perform the following duties:

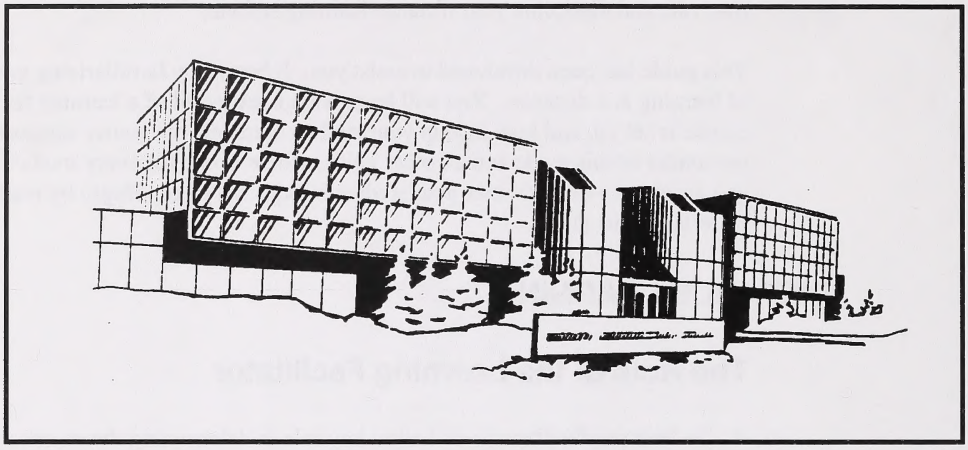
- Be the contact person with the Alberta Distance Learning Centre.
- Ensure the student has a suitable study area.
- Ensure the safe handling of media.
- Ensure that science experiments are done in a safe manner.
- Ensure the student establishes a timetable.
- Supervise the student's completion of modules.
- Monitor the student's progress.
- Provide the student with encouragement.
- Check the student's work, or supervise the student's checking of the activities.
- Supervise the submission of assignments.



The Alberta Distance Learning Centre

The Alberta Distance Learning Centre helps those who want to learn at a distance.

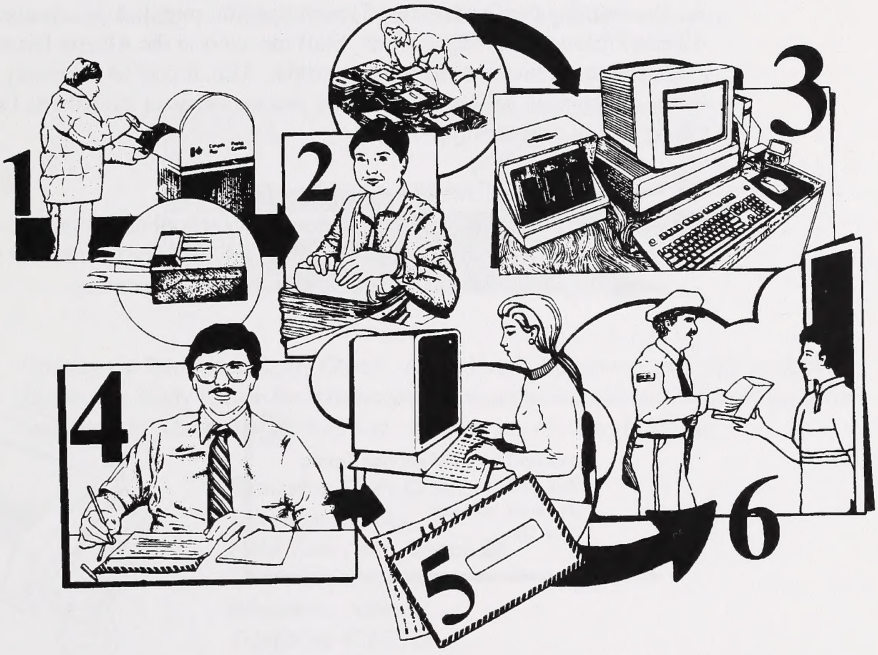
The Alberta Distance Learning Centre



The Alberta Distance Learning Centre helps educate approximately 40 000 students a year from all parts of Alberta, the rest of Canada, and all over the world. Not all of these students study on their own. Some students use distance learning courses to work at their own pace but work in schools or institutions under the guidance of a learning facilitator. The Alberta Distance Learning Centre provides materials for grades 1 to 9, for the core subjects in high school, and for many option courses. All courses follow Alberta curriculum guidelines.

The building, located in Barrhead, Alberta, is about 6 500 m^2. Barrhead is located 120 km northwest of Edmonton. It contains a modern printing and typography unit, an instructional design unit, a teaching unit, a shipping and mailing unit with its own postal code, and a student services unit. The staff numbers about 200. Some teaching staff work in their homes on a contract basis.

How the Assignments Are Processed



1. Your student's assignments are received at the Mailing Department and sent to the Recording Department.

2. At the Recording Department materials are separated and labels are checked to see that they are correct. Assignments are sorted into elementary, junior high, and senior high subject areas.

3. All assignments and tests are entered into the computer.

4. Depending on the teacher to whom the student is assigned, the student's assignments come to the in-house teachers at the Alberta Distance Learning Centre or go to the contract teachers who work at home.

5. Corrected assignments are returned to the Recording Department. The marks are entered into the computer.

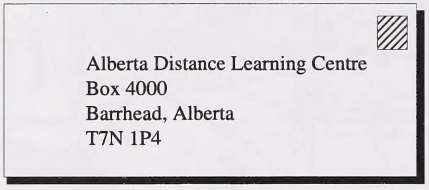
6. The assignments are put into envelopes and mailed back to the students.

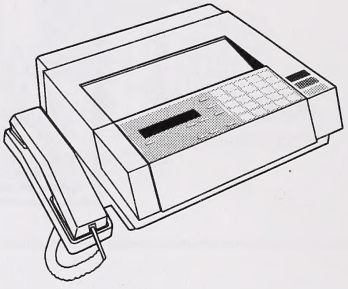
It is important to label your materials carefully so that they are not lost in the masses of paper that are sent to the school.

How to Make Contact

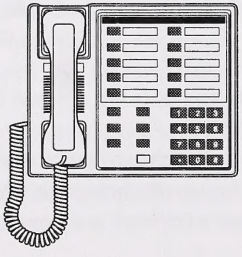
As the learning facilitator, one of your important roles is to be the contact person with the Alberta Distance Learning Centre. Staff members at the Alberta Distance Learning Centre may need to contact you from time to time. Also, it may be necessary for you to contact them. If you need help or information, you may contact the Alberta Distance Learning Centre in one of four ways.

1. You may write a letter to be mailed or faxed.
   The fax numbers are as follows: elementary school department, 1-403-674-6977; senior high school department, 1-403-674-4712. The fax number for the junior high school department was not available at the time of printing.



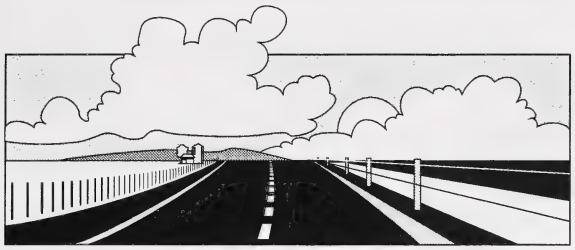


2. You may call the Alberta Distance Learning Centre.



- If you live in the Barrhead area, call 674-5333.
- If you live in other parts of Alberta, you may phone using the one province-wide telephone number that is available to all Albertans wanting to reach a government office anywhere in Alberta. The number is 310-0000. Dial this number and then ask for the Alberta Distance Learning Centre in Barrhead.
- If you live outside Alberta, call 1-403-674-5333.

3. Come to visit the Alberta Distance Learning Centre in Barrhead (120 km northwest of Edmonton). Office hours are 8:15 a.m. to 4:30 p.m., Monday to Friday, except on statutory holidays. Phone ahead if you wish to see a particular person.



4. Contact the Edmonton Study Centre. If you live in Edmonton, you may contact the Edmonton Study Centre for information, some supplies, and as a drop-off point for assignments. The hours are 8:15 a.m. to 4:30 p.m., Monday to Friday.

Edmonton Study Centre
Devonian Building
Main Floor, East Entrance
11160 Jasper Avenue
Edmonton, Alberta
Telephone 427-2766

When you are concerned about course content, ask for a specific teacher or a particular department. When you are concerned about registrations, testing, or accounts, ask for Student Services.

Student

Student

Teacher

Student Services

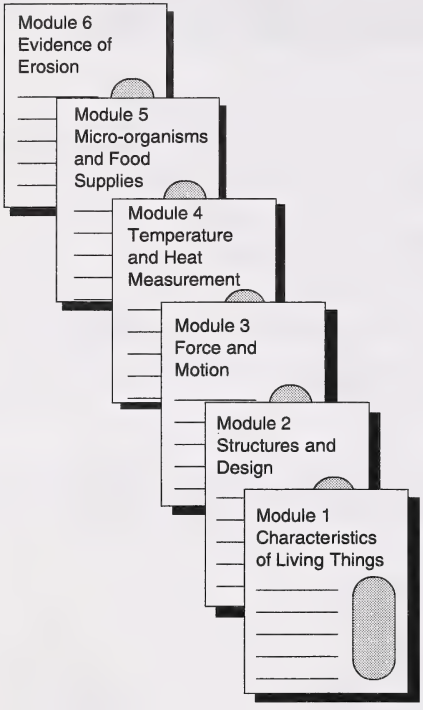
Registrations

ALL ABOUT SCIENCE 7

How the Course Is Designed

This new learning package involves many other components in addition to the student support guide.

Modules

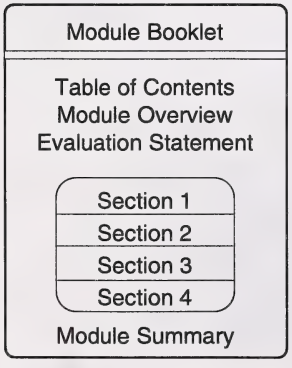


The print components involve booklets called modules.

The structure of the modules in Science 7 follows a systematic design. Each module begins with a table of contents, a module overview, and an evaluation statement.

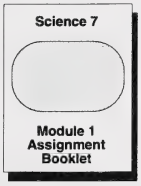
The body of the module is made up of closely related sections. The number of sections will vary from module to module, but each section contains student activities that develop strategies, knowledge, and skills centred around a theme.

At times the student and the learning facilitator are allowed to choose the activity that best suits the student's needs and interests. Other activities are optional. This flexibility caters to each student's personal situation.



The module summary focuses on the main ideas that the student has learned. This is an important part of the module because it discusses how all the ideas in the sections are related.

Assignment Booklets



Accompanying each module is an assignment booklet. The student's mark for each module will be determined by how well they do the assignments in the assignment booklet. If they are having difficulties, they should go back and review the appropriate section in the module booklet. Students are directed to the assignment booklet while working through the module booklet. The assignments usually follow several activities in the module booklet.

There are a number of assignments in the assignment booklet. The total of these assignments is 100 marks.

When the student has completed the assignment booklet, it should be promptly mailed for corrections to the Alberta Distance Learning Centre. While you are waiting for feedback from the teacher, you are encouraged to have the student start the next module.

Media

The learning package also includes reference to media. Pathways have been developed so students can use a variety of media to learn what is important. These different routes have been included to suit different learners. Wherever videos have been included, a print pathway is also available. This way, if the media isn't available or desired, a student can follow the print pathway and still successfully complete the course.

VIDEOCASSETTE

COURSE AUDIOCASSETTE PROVIDING GENERAL TEACHER GUIDANCE

A special audiocassette features a teacher guiding the student through the course. The appearance of the teacher icon reminds students that there is this additional help available.

A DESCRIPTION OF SCIENCE 7

Aims of the Science 7 Course

The Science 7 course aims to develop the following:

- a basic foundation of scientific knowledge
- an understanding of how scientific knowledge is gathered
- an understanding of how scientific knowledge is used to solve practical problems
- an awareness of how science and technology affect the individual and society
- an ongoing interest in science

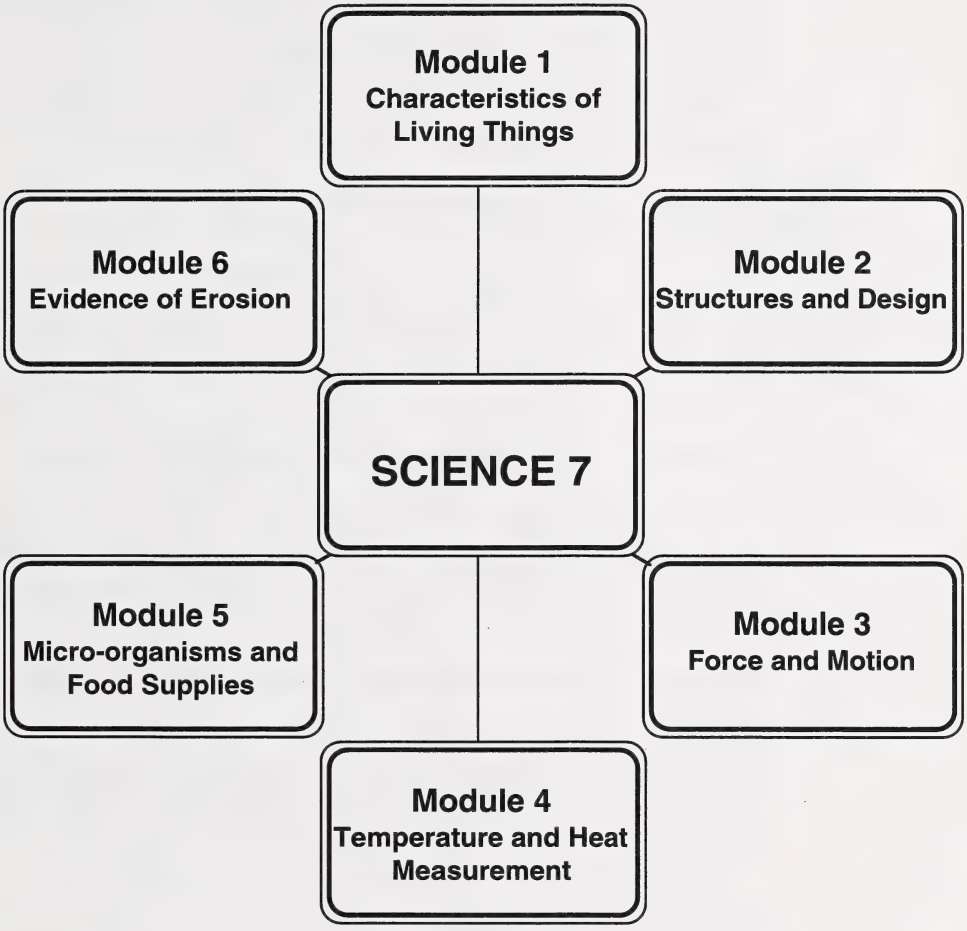
Course Structure

Science 7 consists of six modules. Topics of study include life science, earth science, and physical science. The concepts are introduced through a broad range of experiences – including those based on first-hand experience. Students will need to work closely with a parent or guardian for guidance and for the correction of the activities within each module.

Three important aspects of science education are stressed in Science 7. Each module focuses on one of these three major areas of emphases to develop the topics within the module. However, each module also supports learning with the other two emphases. The three major areas of emphases are

- **The Nature of Science (S)** – the process by which scientific knowledge is gathered
- **Science and Technology (ST)** – the application of science to the solution of practical problems
- **Science, Technology, and Society (STS)** – the effect of science and technology on society

The six modules that make up the Science 7 course are as follows:



Module 1: Characteristics of Living Things

The major emphasis of this module is on the nature of science. Students will examine ways to distinguish between living and non-living things. They will investigate features such as growth patterns, how living things respond to changes around them, and how living things are adapted to survive. Like scientists, students will use their observation and interpretation skills to increase their knowledge of living things.

Module 2: Structures and Design

The major emphasis of this module is on science and technology. Students will be looking closely at structures and at the way they are put together. They will compare structures such as buildings, bridges, and furniture, with structures that exist in the natural world. Students will have the opportunity to plan and build some structures on their own. They will discover how to choose the best materials for making the structures, and they will discover why one design is stronger than another.

Module 3: Force and Motion

The major emphasis of this module is on the nature of science. This module provides students the opportunity to study a variety of forces and to examine the effects of those forces on objects and materials. Students will learn to recognize and measure forces, then focus on the effects of those forces within different systems and in different applications. A study of the causes and effects of friction, and a study of motion in space are also part of this module.

Module 4: Temperatures and Heat Measurement

The major emphasis of this module is on the nature of science. This module examines the effects of heat and temperature changes with particular attention to methods of measuring these. The uses of different sources of heat are considered, and comparisons of the heat energy in various fuels and food are made.

Module 5: Micro-organisms and Food Supplies

The major emphasis of this module is on science, technology, and society. Students will learn about health problems that result from improper food preparation and handling, what micro-organisms are and where they live, how micro-organisms affect our food, how our food can be kept safe from micro-organisms, and how society makes decisions about safe handling of food.

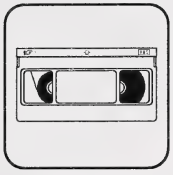
Module 6: Evidence of Erosion

The major evidence of this module is on the nature of science. This module examines changes in the surface of the earth, which result from the erosion, transport, and deposition of earth materials. Students will learn how even the hardest rocks are slowly broken down into smaller pieces, and how these pieces are moved by wind, water, and ice. They will make inferences about how the landscape has changed over time.

Symbols and Terms Used in This Course

Symbols

Science 7 has a number of symbols in the margins. These symbols are used throughout the course.

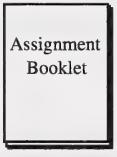


Videocassette

Textbook

Course Audiocassette providing general teacher guidance

Read



Assignment Booklet

Be sure that you and the students become familiar with these symbols.

Terms

When new terms or concepts are introduced in the course, it is important that the students understand that the terms are new and that they should read carefully to fully understand what the terms mean. The course has been designed so that new terms or concepts are given special attention. They are **defined** and **explained** within the sentence or paragraph. Their meaning is provided at the bottom of the page or in a note in the margin. Also check the beginning of the appendix in each module booklet. Sometimes a special glossary is included. As you supervise, make sure the students know what the new term and concepts are and what they mean.

COURSE MATERIALS

Materials

Materials Supplied	Materials Required	Optional Materials
Courseware Student Support Guide Module Booklets (6) Assignment Booklets (6) **Media** Special audiocassettes providing general teacher guidance	**Textbook** Science Directions 7 **Media** **Other Books** Laboratory Supplies (For a list of laboratory materials, see the introductory pages to each module in the Student Support Guides.)	**Media** VCR (VHS) audiocassette player **Other** Videocassettes used in the course may be available from the Alberta Distance Learning Centre or call your local school authorities.

When you receive your course materials, you should take time to look carefully at what you received. **Take note that your entire course may not be sent at one time.** If you received the wrong course or your course is defective in any way, notify the Student Services Department of the Alberta Distance Learning Centre immediately.

Many of the items that students need in order to complete the laboratory work are everyday items which you may have at home or which can be easily purchased at a grocery store or a hardware store. These items should be collected in advance so that students will not be held up when they start work. In some cases if the materials suggested are not readily available, the learning facilitator may be able to susbstitute suitable materials for the student or make arrangements to use laboratory facilities at a local school so that the activities can be completed successfully. In other cases the student may need to choose a pathway which does not require the materials, or may need to contact the Alberta Distance Learning Centre regarding the purchase of a kit containing some of the more specialized items needed, if this has not yet been done.

Handling the Courseware

Courses may involve audiocassettes and/or videocassettes. Whether the material is loaned or purchased, it is important to take care of these items. Scratches, dirt, grease, extreme temperatures, or magnetic fields such as those in electric motors will damage them.

EVALUATION

There are two kinds of evaluation used in the course: informal and formal. As the learning facilitator you will take part in the informal evaluation.

Informal Evaluation

The course contains two types of activities. In the module booklets there are learning activities that include basic practice and questions that help guide the students to a better understanding. It is important that these activities are corrected as soon as possible so the students get immediate feedback to confirm and clarify their understanding before they go on.

In a classroom these types of activities would be corrected as they are completed by the teacher or by the students. In distance learning courses at the high-school level, the answers for these activities are included in the appendix of each module booklet so that the students can mark the activities themselves. **At the elementary and junior-high level, correcting the activities and discussing the results is one of the most important duties of the learning facilitator.**

When the student has completed an activity, you should skim over it before correcting to be sure the student has spent enough time and effort on the activity.

When checking a student's work, first focus on the work the student has done correctly and then comment on the student's effort. Then, if necessary, spend time clearing up any misunderstandings.

Following are a few suggestions that have proved to be constructive ways of handling errors. First, stop to consider why there are errors. Ask yourself the following questions:

- Is the student repeatedly making the same mistakes or do the errors appear to be random?
- Do the errors appear to be the result of carelessness?

If the student is repeatedly making the same mistakes, you may need to read through that section and explain in your words what the main ideas are.

If the error is random and doesn't have a serious impact, then it is worth ignoring.

If the error appears to be careless, you may need to

- check to see if the student understands the directions
- relate the activity where the errors occur to some meaningful aspect of the student's life
- discuss the information with the student
- have the student slow down
- give the student a rest

Always instruct the student to correct incorrect answers. The module booklet becomes an important reference when doing the assignments, and it is essential that it is accurate.

Remember, it is very important that students not only learn from their corrections, but that they also realize that making mistakes is a normal part of learning.

You may decide to let the student correct some of the activities after you have ensured that the student has spent enough time and effort on the activity. Make sure that you see the activity with its corrections before letting the student go any further in the module booklet.

It is of little value to students if you do their work. How many items are incorrect is not the most important thing, but how the mistakes are handled. Sometimes it is easier when you're guiding the student to put in the answers, but it does not help the student learn the concept. Activities with examples have been included with the student modules to provide guidance for the students.

Formal Evaluation

Formal evaluation is based on the assignments in the assignment booklets and a final test. These are marked by a distance learning teacher. There is an assignment booklet for each module in the course. The assignments are based on the work the student has completed in the module. The student may refer to the module booklet while completing the assignments. The following chart shows the percentage of the final course mark assigned to each module. The final mark is determined by how well the student does on all the modules.

Module 1: Characteristics of Living Things	**10%**
Module 2: Structures and Design	**10%**
Module 3: Force and Motion	**10%**
Module 4: Temperature and Heat Measurement	**10%**
Module 5: Micro-organisms and Food Supplies	**10%**
Module 6: Evidence of Erosion	**10%**
Final Test	**40%**
TOTAL	**100%**

Module Evaluation

Each assignment booklet submitted to the distance learning teacher is evaluated on the basis of the student's demonstrated understanding of the concepts taught in that module, completeness of work, neatness, and legibility. A letter grading is then assigned which follows the scale of percentage or performance equivalencies below.

A	80% – 100%	Outstanding
B	65% – 79%	Good
C	50% – 64%	Satisfactory
D	40% – 49%	Needs Improvement
F	0% – 39%	Unsatisfactory
I	Incomplete	Follow distance learning teacher's directions and return entire module in order to receive a grading.
R	Repeat	

Final Mark

Science, being a core subject in Junior High, requires the writing of a final examination which must be supervised by a responsible adult. (See the *Handbook for Junior High Students* for details.) This supervised test must be written before the student's registration expires. The test will not be returned to the student. In order to receive a passing grade in Science 7, the student must score a "D" or better on the final exam and have an overall standing of "C" or better for the entire course.

The final mark is determined by how well the student does on all the modules and the final test. The test will make up 40% of the student's mark. The other 60% will be based on course work, as evaluated by the student's distance learning teacher. If a student is dissatisfied with a mark, an appeal test may be requested. Such a request must be made by the student within thirty days of receipt of the result statement.

Report Cards

Report cards are mailed twice a year – in October and in February – to all nonschool students under sixteen years of age. The principal or superintendent is also sent a copy of the report card. This card shows the number of modules completed in the course, the average grading per module, and the final mark received for the completed course.

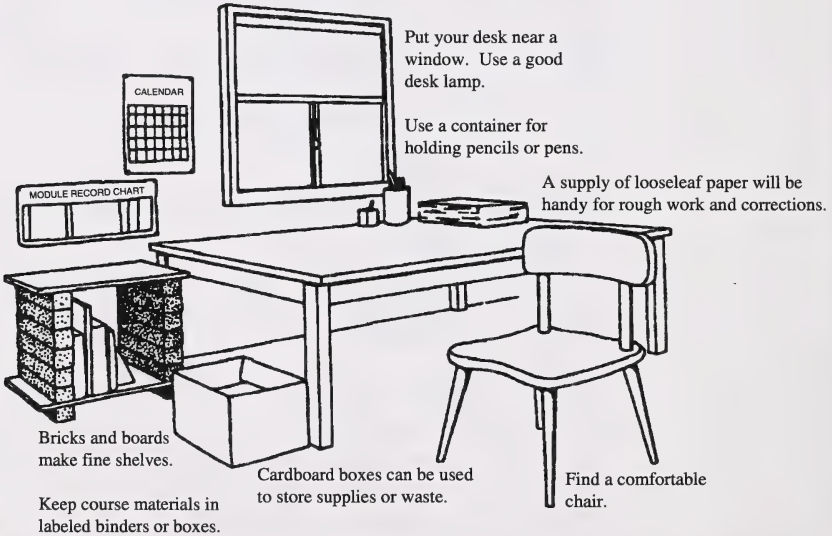
STARTING OUT RIGHT

Proper planning, organization, and good study habits will help your student to succeed in acedemic studies. This section of the guide will give you and your student some idea of how to use time efficiently so that the student can achieve predetermined goals. If you are new to distance learning, both you and the student will probably benefit from the tips on time management and study habits in this section.

Setting Up Shop

Probably one of the best ways to ensure success in distance learning is to establish a study corner. This is a quiet, well-lit area where the student can leave books, papers and supplies. It should be an area where there are no distractions – telephone, radio, television, or people engaged in other activities. Find the best place for studying in your home. A comfortable chair and sufficient work space (table or desk) are essential. All necessary supplies, tools, materials, and books must be gathered. The work area could contain exercise equipment like barbells or even an exercise bike. When your student begins to feel sluggish, encourage a ten minute exercise break.

The following diagram may be helpful for organizing your study area.


Put your desk near a window. Use a good desk lamp.
CALENDAR
Use a container for holding pencils or pens.
MODULE RECORD CHART
A supply of looseleaf paper will be handy for rough work and corrections.
Bricks and boards make fine shelves.
Keep course materials in labeled binders or boxes.
Cardboard boxes can be used to store supplies or waste.
Find a comfortable chair.

Students should keep these things in their work area:

pens	atlas	extra paper	writing portfolio	return envelopes
pencils	eraser	thesaurus	library books	module materials
glue	dictionary	timetable	pencil crayons	ADLC phone number

An efficient student work place will help learning.

Time Management

There are so many demands on our time nowadays that we really must make the effort to organize our work and our activities. This organization or planning is called time management.

With distance learning, it is a necessity that the student plans a schedule. Your duty is to ensure that the student does some advance planning. Check the final plans to see if they are realistic.

Only you and the student knows exactly how much time is available for completing a course. It does not matter too much what time of day the student does course work – this varies with the individual's situation. Distance education is flexible. To decide exactly how much time the student must make for studies, the student must set priorities. Together you must decide exactly when you wish to have the course completed. You must take into account time worked away from home, time needed for chores, and time needed for recreation and relaxation when you make this estimate.

Make a Weekly Plan

Discuss with your student the importance of weekly planning.

People who write for a living always have deadlines to meet. They cannot wait for inspiration. They discipline themselves to sit down and write for a number of hours every day. Whether they like it or not, they stick to a schedule. This determines success.

Work with your student to

- keep track of what your student usually does in a typical week
- plan the studies your student can do in a typical week
- keep a list of what your student must do each day and cross off each study task as it is completed
- find your student's own best time to study
- set deadlines and stick to them
- not dwell on failures and get back on schedule

Have the student fill in a weekly timetable.

Sample Weekly Timetable

Begin when the student usually wakes up.

↓

Write in every hour.

↓

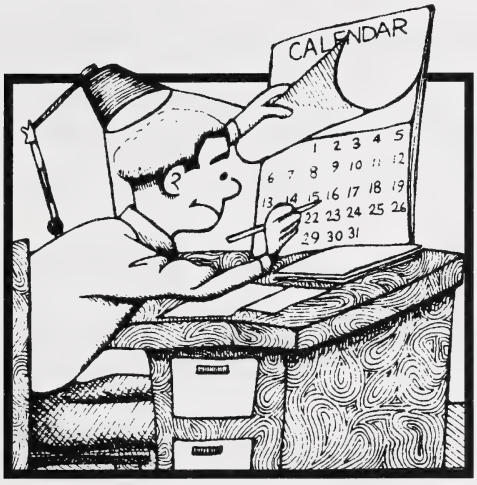
End when the student usually goes to bed.

Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday

The student should keep track of every major activity. It is not wise to plan to use 100% of the student's time. Allow for possible interruptions and jobs taking longer than planned.

Make a Monthly Plan

The next step is planning a monthly schedule with your student. The student should block off the days that are not available for studying.



- Count the days that are available between the start of the course and the desired finishing date.
- Allow time for review.
- Count the number of sections or modules that must be completed within this time.
- Estimate how many days are available to complete each section and each module.
- Make a monthly plan like the one below.

Sample Monthly Timetable

September

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
					1	~~2~~
~~3~~	~~4~~	5	6	7	8	9
10	11	12	~~13~~	14	15	~~16~~
17	18	19	20	21	22	23
~~24~~	25	26	27	~~28~~	~~29~~	30
Total Work Days Available for Study						
Goal :						

Make a Course Plan

When you both have an idea of how much time is available every day, week, and month, look at a plan for completing the course(s) that the student is studying.

Modify these plans as circumstances change. Be flexible, but don't procrastinate.

Our experience has shown that a planned approach to module completion is far better than the hit-and-miss method of completing modules now and then, as you feel like it.

Sample Course Timetable

Course Name _____ Date of Starting _____

Planned Completion Date _____ Actual Completion Date _____

Module	Planned Completion Date	Actual Completion Date	Date Mailed	Date Returned

The student needs determination and perseverance to continue working independently. The student also needs your positive support and interest to keep motivated.

Supervising the Completion of Modules

Try to ensure that the student is following the timetable established as closely as possible and that the target dates for module completions are being met. If, for some reason, the student misses time from studying, the student should spend additional time during the evenings or weekends, so as to complete the course(s) within the desired time limits.

When the student has completed the learning activities, you should allow the student to do the assignment in the assignment booklet. Afterwards you should go over the assignment to ensure the student has spent enough time on the assignment. When the entire assignment booklet is done satisfactorily, submit the assignment.

Basic Study Tips

Planning and good study habits will help the student to succeed in distance learning. Here is a short list of important tips to discuss with the student.

- Work together to make a course plan and weekly timetable, and follow them as closely as you can.
- Remember that mornings are usually better for concentration. Learning styles may vary from student to student.
- Check to see that all necessary materials and supplies are close by before starting work.
- Have the student take relaxation or exercise breaks between study periods.
- Be sure that the student completes all activities carefully and reviews corrections before moving to other assignments.
- Ensure that the student understands and follows directions carefully when completing activities. If the student is unclear about what to do, the student should then start by rereading the directions. If there are still problems, the student should discuss the activity with the learning facilitator. Sometimes reviewing the previous activities is helpful.
- Ensure that written responses are the student's own work.
- Encourge the student to switch subjects or activities before they become stale. If the student is working regularly and truly concentrating, one or two hours on one subject should be enough at one sitting.
- Have the student be sure that writing is neat, legible, and complete.
- Encourage students to discuss their reading and writing with you.

PROCEDURES

How to Send in Your Assignment Booklets

Assignment booklets, along with any other requested materials, should be submitted to the Alberta Distance Learning Centre as soon as possible after the completion of each module in order to obtain speedy, regular evaluation and feedback. The student can proceed with the next module while waiting for the return of the assignment booklet.

Please ensure that your student's file number is on all assignments, tapes, and disks sent to the Alberta Distance Learning Centre.

Report any change of address immediately. If a change is not reported, it is impossible for the school to forward information, letters, or test applications.

Mailing

The student is required to pay the postage on everything sent or returned to the Alberta Distance Learning Centre. To speed up handling, first-class postage is recommended on all assignments submitted.

The student is expected to perform assigned work and to correspond with teachers and administrative staff in an appropriate manner. The Alberta Distance Learning Centre reserves the right to cancel, without refund, the course of any student whose conduct is unbecoming.

Do not enclose letters concerning fees, guidance, additional courses, final tests, or general inquiries with assignments. Send these by separate mail to speed their handling and to avoid their being misplaced.

Dropping Off Your Assignment Booklets

You may drop off assignments at the Edmonton Study Centre or in Barrhead at the Alberta Distance Learning Centre.

Faxing Your Assignments

Be sure the covers of your assignment booklets are filled in correctly with the proper label attached.

Check to see that all response pages have been completed as directed.

Check to see that all faxing boxes located at the bottom of each response page have been clearly filled out.

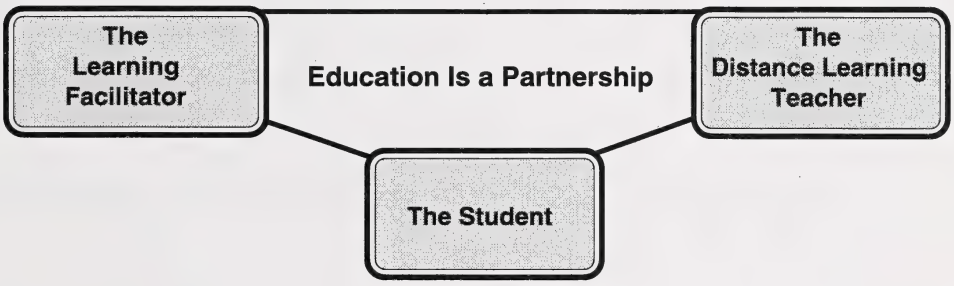
Costs for faxing assignments to the Alberta Distance Learning Centre are the responsibility of the student.

What to Do with Returned Assignment Booklets

Review returned assignments carefully with the student, noting the marks, teacher's corrections, and comments. The teacher may suggest that you make certain choices of activities in future modules to help you practise needed skills. Your teacher may also ask you to complete skill activities which are either included in the course or sent to you by the teacher. Returned assignments should be kept for future review and study.

SUMMARY

This introductory section of the Student Support Guide has been developed to assist you in your role as learning facilitator. Develop a routine with your student and a good working relationship. Remember, education is a partnership.



Learning Facilitator: Please help your student complete this form and return it with the first assignment booklet.

Student Questionnaire for Science 7

Name _____ File Number _____

Address _____ Telephone Number _____

_____ Age _____

_____ Date _____

1. Provide details of the last Science course you completed successfully.

   Course: _____ Year Completed: _____

   School: _____ Final Mark: _____

2. What school are you attending now (if any)? _____

3. Are you working on this course ❑ at home? ❑ at school? ❑ at both?

4. Are there other students in your school/district taking distance learning courses? ❑ Yes ❑ No

5. Are there other students in your school taking this course through distance education?
   ❑ Yes ❑ No

6. What other distance learning courses are you taking? _____

   _____

   _____

7. Have you taken a distance learning course before? ❑ Yes ❑ No If yes, when? _____

8. Why are you taking a course through distance learning now? _____

   _____

9. Mention any special factors (handicaps, illness, family problems, etc.) which may influence your progress in your studies.

   _____

   _____

In order to get to know you better, we would like you to tell us a bit about yourself. Write a paragraph or two telling us about yourself, your plans for the future, or anything else about yourself that you think would interest us.

Please attach a recent photo of yourself if possible.

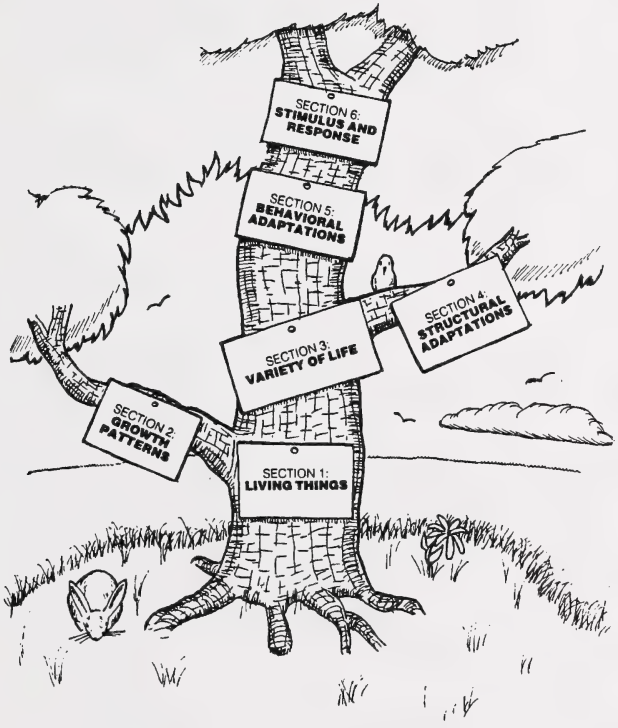
Name of Student _____ Student I.D. # _____

Name of School _____ Date _____

Module 1 - Characteristics of Living Things: Overview

The major emphasis of this module is on the nature of science. Opportunities are provided to reinforce and develop science inquiry skills, with particular attention given to observation, organizing and presenting data, and experimental design.

In this module students will investigate features such as growth patterns, how living things respond to changes around them, and how living things are adapted to survive. Like scientists, students will use their observation and interpretation skills to increase their knowledge of living things.


SECTION 6: STIMULUS AND RESPONSE
SECTION 5: BEHAVIORAL ADAPTATIONS
SECTION 4: STRUCTURAL ADAPTATIONS
SECTION 3: VARIETY OF LIFE
SECTION 2: GROWTH PATTERNS
SECTION 1: LIVING THINGS

Evaluation

The student's successful completion of all assignments will depend on practice obtained while doing the various activities. Many choices of activities have been provided so that students have some control over their own learning.

The following distribution of marks is suggested in determining the student's grading for this module.

Section 1 Assignment	**15 marks**
Section 2 Assignment	**17 marks**
Section 3 Assignment	**15 marks**
Section 4 Assignment	**15 marks**
Section 5 Assignment	**15 marks**
Section 6 Assignment	**23 marks**
TOTAL	**100 marks**

Although the value of each module for the Science 7 course is the decision of the classroom teacher, it is suggested that Module 1 be worth 10% of the total final grade, based on equal weighting of the six modules in this course, plus a final test.

Materials Needed for Module 1

Comment: In order to assist students effectively in their study of this course, it may be helpful to preview Module 1. This will give you an idea as to how the topics are developed; it will also give you an overview of the materials needed in the module. In some cases if the materials suggested are not readily available, the learning facilitator may be able to substitute suitable materials for the student, so that the activities can be completed successfully.

The materials needed for Module 1 and the activities in which they are to be used are as follows:

Section 2: Activity 5

- two small glass jars
- marking pencil
- paper towels
- small pie plate or bowl
- four bean seeds

Section 3: Activity 2

- water
- 500 mL measuring cup
- plastic bucket
- waterproof marking pen
- four identical balloons or freezer bags

Section 3: Extra Help 1

- ruler
- pencil
- sheet of paper (graph paper or plain paper)

Section 3: Enrichment

Note: This "Extra Special Challenge" activity is optional. The materials needed are parts of plants from your local area.

Section 4: Activity 4

Part B – Note: Students may choose Part A, which does not require any materials.

- potato
- paint
- toothpicks
- modelling clay
- glue
- white latex paint
- brush
- tongue depressors
- cotton wool
- tape

Section 6: Enrichment

- clock or watch

The remainder of this Student Support Guide for Module 1 contains the answers and guidance to assist you in correcting the student's work in the Activities. Comments where applicable are made to guide the learning facilitator.

Correct and discuss the answers with the student as the student completes each activity. In this way the student receives immediate feedback to clarify and reinforce basic understanding before moving on to the next Activity.

Towards the end of each section there are Follow-up Activities. Here the activities are separated into two strands: Extra Help and Enrichment. If students had some difficulties understanding the concepts and the activities within the sections, it is recommended that they do the Extra Help. If students had a clear understanding of the concepts and had few difficulties completing the section activities, it is recommended that they do the Enrichment. As the learning facilitator, you should assist the student in choosing the appropriate path in the Follow-up Activities.

The assignments in the Assignment Booklet are to be done under the supervision of a learning facilitator. Ensure that the student always supplies his or her own written responses in the Assignment Booklet. Because these are not tests, the students can refer to the Module Booklet and any additional notes that have been made. Assignments are always marked by a teacher. Wait until all the assignments are completed before submitting the Assignment Booklet.

Section 1: Living Things

By the end of this section students should be able to

- distinguish between living and non-living things
- explain the difference between dead and non-living things
- identify and describe five characteristics of living things

Section 1: Activity 1

1. taste, c
2. touch, d
3. smell, e
4. hearing, b
5. sight, a

Section 1: Activity 2

Note: Students are to do either Part A or Part B.

Part A

Living	Non-Living	Dead
deer birds (owl and magpie) trees grass bush squirrel	fire frying pan tent axe head fishing rod smoke	fish dead tree firewood leaves on ground

Part B

Step 2: Comments – Objects and living things listed should be appropriate to the heading under which each is listed. In some cases it is possible that an object might be listed under more than one heading; e.g., an object such as a grain elevator may be made of several parts. One part, such as the wood it is made of, may be considered dead. Other parts may contain concrete, stone, or metal which are non-living. Check to see that students are able to give reasons why they placed the object under the heading they choose.

Step 3: Comparisons will vary.

Section 1: Activity 3

- All organisms grow.
- All organisms move.
- All organisms reproduce.
- All organisms produce or take in food.
- All organisms respond to stimuli in their environment.

Section 1: Activity 4

Thing	Living	Non-Living	Reason
dandelion	x		Dandelions • grow bigger • move toward light • make seeds which create more dandelions • shrivel in response to weed killer • make their own food
campfire		x	Campfires do not make their own food, and they do not take in food. Fuel must be supplied to the fire.
earthworm	x		Earthworms • grow • move through soil • reproduce • respond to water and presence of food • take in food
maple tree	x		Maple trees • grow • move materials from the soil to the leaves • reproduce • respond to sunlight • make their own food
diamond		x	Diamonds • do not move on their own • do not need food • do not reproduce • were formed from coal, which is the remains of living things
bean seed	x		Bean seeds • grow to become a bean plant • respond to light • respond to moisture • make their own food
banana (cut from tree)	x x		• If the student considered that the banana is a product of a tree, it would be classified as living. • If the student mentioned that banana slices do not grow, do not reproduce, do not make or use food, and do not move on their own, then it could be considered as non-living.
burning candle		x	Burning candles • do not grow • do not reproduce
leaf on a poplar tree	x		A poplar leaf • grows • is capable of producing food • is part of a living thing which can reproduce

Thing	Living	Non-Living	Reason
sun		x	The sun • does not reproduce • does not produce or take in food
salt crystal		x	Salt crystals • do not produce or take in food • do not move on their own
strand of hair	x		• If the student considers the strand of hair as a product from the organism it came from, then it would be classified as living.
		x	• If the student mentions that strands of hair do not move, do not reproduce, and do not take in food, then accept it as being non-living.

Section 1: Follow-up Activities

Extra Help

1. living, non-living, dead

2. An organism is a living thing. Organisms have the characteristics of living things.

3. growth, responsiveness (to stimuli), ability to move, ability to take in or make food, ability to reproduce

4. a. living: Humans have all five characteristics of living things.

   b. living: A flower has all five characteristics of living things.

   c. non-living: A rock does not grow or reproduce and is not able to move on its own.

   d. non-living: A cloud does not use or produce food.

   e. living: A housefly has all five characteristics of living things.

   f. non-living (or living): A book in its present form does not have the characteristics of living things, but the paper in books is made from a material that was once part of living things.

Enrichment

1. You can see cells in living things and in dead things by using a microscope. Non-living things are not made of cells.

2. Dead things do not move, do not reproduce, do not grow, and they do not respond to stimuli.

3. Dead things have cells. Students might also indicate that the appearance remains similar to what it was when it was living.

Note: The student should now complete the assignment for Section 1 in the Module 1 Assignment Booklet.

Section 2: Growth Patterns

By the end of this section students should be able to

- describe patterns of growth of a variety of organisms
- describe and compare different life cycles
- write an hypothesis for a question
- identify variables for an hypothesis

Section 2: Activity 1

1. As Peter grows older, he grows taller. However, the line is not a straight diagonal, and this indicates that Peter's growth rate was not the same each year.

2. Peter grew the most between his twelfth and thirteenth birthday.

3. He grew twenty-six centimetres in the year of his growth spurt.

4. No, growth rates vary between individuals. The growth spurt happens between the ages of fourteen and sixteen years in many boys. Peter's growth spurt occurred earlier than that of most boys.

5. a. Peter's period of slowest growth was after the age of thirteen years (or between age fourteen and sixteen).

   b. Answers will vary. Peter's growth was slow during this time because he had already experienced his growth spurt. Or, Peter was probably approaching his mature height.

Section 2: Activity 2

1. Suitable answers might include the following ideas:

   The outside covering of the water boatman does not allow growth.
   The covering must fall off before the water boatman can grow.
   Most growth occurs when the outside skeleton (exoskeleton) is shed.

2. Both get larger as they grow older.

3. The water boatman only grows in spurts; Peter's growth is more continuous.

Section 2: Activity 3

1. egg mass, f, a, d, e, c, b, adult frog

2. Answers will vary. The body parts that are present or the overall size of the various body parts as shown in the diagrams might have helped.

Section 2: Activity 4

1. • variable: temperature
   reason: Plants grow mainly in the spring and summer.

   • variable: moisture (water)
   reason: Plants need water to grow.

   • variable: light (or darkness)
   reason: Some seeds will not grow unless they are covered.

Section 2: Activity 5

Comments: If bean seeds are not available, radish seeds or other available seeds may be used instead.

Observations

Answers will vary. Observations should show that the soaked seeds germinate earlier than unsoaked seeds.

Interpretations

1. a. Answers will vary. Check to see if observations support the hypothesis.

   b. Answers will vary and will need to be evaluated on an individual basis.

2. a. Without the unsoaked seeds you would not know if soaking the seeds actually made a difference. They are needed as a control.

   b. Only one variable at a time should be changed; all others should be kept constant in a controlled experiment. (Student answers may refer to the idea of a fair test.)

   c. This provides a way to make the roots visible while the plant is growing.

Section 2: Activity 6

Hypothesis

1. Various answers may be given. The following are sample answers.

   a. HYPOTHESIS: Seeds placed in soil will grow more quickly than seeds not placed in soil.

   b. HYPOTHESIS: Placing the seed in sand will not help it grow.

   c. HYPOTHESIS: Placing some fertilizer with the seed will cause it to grow more quickly.

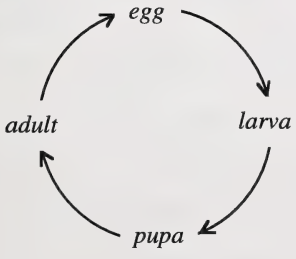
   d. HYPOTHESIS: Placing salt next to the seed will kill the young plant.

   e. HYPOTHESIS: Placing a seed in a warm place will help it start to grow.

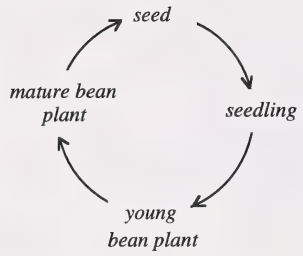
Section 2: Activity 7

Note: Students are to do either question 1 or question 2.

1.



2.



Section 2: Follow-up Activities

Extra Help

1. a. organism c. characteristics e. variable g. adult i. larva
   b. life cycle d. species f. hypotheses h. graph j. reproduction

2. 3 She collected all the things she needed for the experiment.
   6 She wrote a report about what she had learned from her observations.
   2 She wrote a hypothesis on variables that might affect plant growth.
   5 She recorded all her observations in a chart.
   4 She carefully observed radishes growing under different conditions.
   1 She listed several variables that might affect plant growth.

Enrichment

1. Answers will vary. As previously indicated, all answers must be testable. Example: The dog's body will grow more than its ears and feet.

2. Answers will vary. Example: length of ears, width of tail, length from nose to hind end

3. Answers will vary. Based on the previous example, the chart might look like this.

Age (Months)	Ear Length (mm)	Foot Width (mm)	Body Length (mm)
0			
1			
2			
3			
4			
5			
6 etc.			

Note: The student should now complete the assignment for Section 2 in the Module 1 Assignment Booklet.

Section 3: Variety of Life

By the end of this section students should be able to

- identify and describe similarities and differences between groups of living things
- recognize and describe variation within a group of living things
- identify characteristics that could be used to classify organisms

Section 3: Activity 1

1. a. Answers will vary.

   b. Answers should provide a reasonable interpretation based on observations and previous knowledge.

2. a. Answers will vary.

b. Answers should provide a reasonable interpretation based on observations and previous knowledge.

3. a. The dragonfly flies the fastest.

   b. It must catch other insects for food.

4. a. The butterfly flies the slowest.

   b. From personal observations, students should realize that a butterfly moves more slowly.

5. Students' answers will vary. The chart in the textbook that students were referred to states that the dragonfly flies the fastest at forty kilometres per hour, and the butterfly flies the slowest at eight kilometres per hour. Check to see how the student's answers in questions 3 and 4 compare to this.

Section 3: Activity 2

Comments:

- The learning facilitator should help the student obtain the necessary materials to do this Activity. (The Materials You Need and the Steps to Follow are stated in the student module.)

- The learning facilitator should supervise the student to check that steps 1 to 8 are properly carried out.

Observations

Answers will vary.

Interpretations

1. Answers will vary. Answers will be based on observations made.

2. Answers will vary. Check students' answers with results given in the observation charts.

3. Answers will vary. Factors such as height, weight, chest size, physical activity, and age might be considered here.

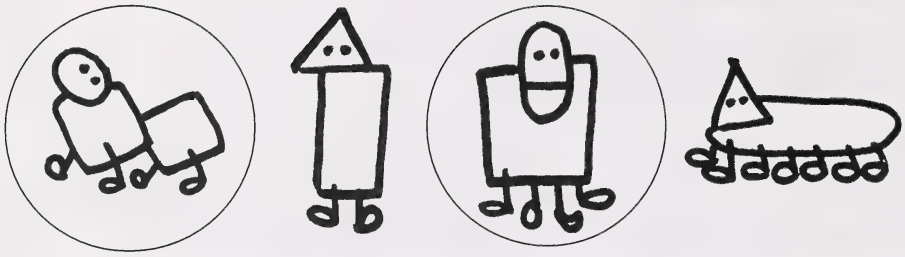
4. a. to c. Answers will vary. Check to see that steps 4 to 7 of Steps to Follow were properly done to obtain the results here.

Note: If you are in a situation where you are unable to measure the actual lung capacity of the person you selected, proceed to question 5.

5. You could test more people. With more observations, explanations should improve.

Section 3: Activity 3

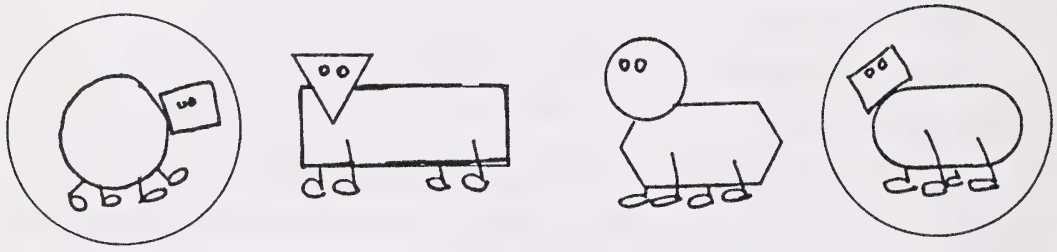
1. a.



b. All Doles have exactly four legs.

c. Drawings should be consistent with the identified characteristic.

2. a.



b. The trunk of all Gleeps consists of one or more rounded body parts.

c. Drawings should be consistent with the identified characteristic.

Comments: By doing a fun activity involving imaginary creatures, you have practised the skill of identifying similarities and differences. Using imaginary creatures allows simpler classifying. Real organisms are much more complex. Often the criterion for a group cannot be determined by just observing the physical appearance of an organism.

Section 3: Follow-up Activities

Extra Help 1

Comments: This activity is best done with students of approximately the same age, such as classmates or friends. Students should try to measure the handspans of at least fifteen people, but if this is not possible in the student's particular situation, this activity can be done with fewer people.

Observations

Answers will be based on actual data collected.

Optional: Variations in People's Handspans – The graph should be consistent with the data collected (as shown in the students' chart.)

Interpretations

1. Answers should be consistent with data gathered.

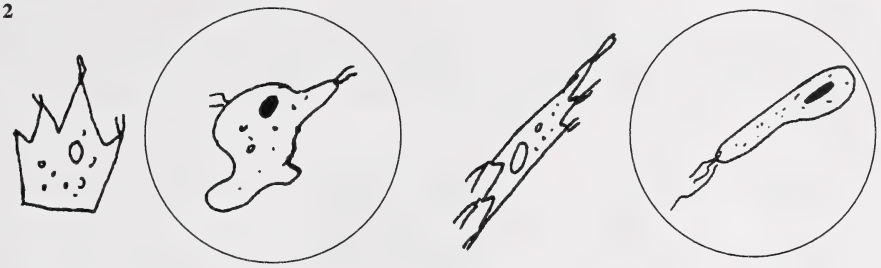
2. a. Answers will vary. Small hands would be an advantage when the task requires getting into small spaces or working with small equipment.

b. Answers will vary. Large hands are an advantage when handling large tools or equipment or playing a musical instrument that requires a large reach.

3. Answers should show evidence of critical thought.

Extra Help 2

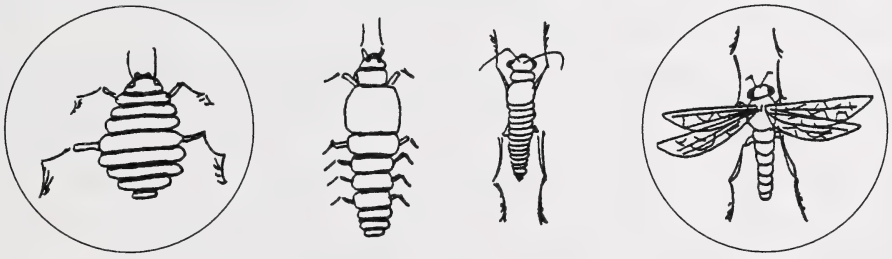
1. a.



b. Woozles have a large dark spot.

c. Drawings should be consistent with the identified characteristic.

2. a.



b. Klaks have two pairs of legs and eight body segments (in addition to the head).

c. Drawings should be consistent with the identified characteristics.

Enrichment 1

- The mustard plant has broad leaves; chamomile leaves are very narrow and split into many parts.
- The chamomile has a larger flower than the wormseed mustard.
- The chamomile flower has large petals at its edges; the mustard flower does not have such large petals.
- The mustard plant has a group of erect seed pods around a central stem; the chamomile does not.
- The chamomile flower has a rounded half-ball shape at its centre; the mustard flower does not.

Enrichment 2

1. a.

b. Flowers or seed pods are arranged around a single upright stem, much as bristles on a bottle brush. The seed pods or flowers are turned upwards and are supported by a short stem.

c. Drawings should be consistent with the identified characteristics.

d. For any materials submitted, the characteristics of any plants identified as mustard plants should be consistent with what is indicated previously; i.e., plants should have upright stems; flowers and/or seed pods should be arranged axially around the stem. Flowers have four petals, four sepals, and six stamens. Seed pods generally have a thin partition which separates the pod into two parts. Common examples of this family include: stinkweed, peppergrass, shepherd's purse, ball mustard, wild radish and wild mustard. Students may wish to consult additional references.

2. a.

b. Diptera have six legs and an observable pair of lacy wings.

c. Drawings should be consistent with the identified characteristics.

3. a. to d. Answers will vary. Answers in each part of this question should fit together in the same way as for previous material. You may wish to begin by viewing the student's answer for "d," and then checking to see if all other parts of the answer are consistent and clear.

4. Answers will vary for this optional activity. Work submitted should be evaluated in a similar way to the previous question.

Note: The student should now complete the assignment for Section 3 in the Module 1 Assignment Booklet.

Section 4: Structural Adaptations

By the end of this section students should be able to

- describe animal and plant adaptations
- explain the value of adaptations

Section 4: Activity 1

1. INFERENCE: The rabbit's speed helps it escape predators.
   Rabbits do not have a good way of defending themselves, especially from animals that come from behind.

2. INFERENCE: The quills help protect the porcupine from enemies.
   Porcupines move slowly and may have difficulty moving away from enemies.

3. INFERENCE: The duck's webbed feet help it move through water.
   Ducks are generally found around or in water. They seem to move easily through water.

Section 4: Activity 2

1.

a. skimmer	d. flamingo	g. merganser	j. woodpecker
b. crossbill	e. hummingbird	h. mallard	k. sapsucker
c. avocet	f. nighthawk	i. falcon	l. great blue heron

Section 4: Activity 3

Note: Students are to do either Part A, Part B, or Part C.

Part A: Plant Diagram and Interpretations

Students will choose one of the plants listed. Diagrams will vary. The diagram should reasonably illustrate the adaptation that was selected.

Answers will vary, but they should be appropriate to the adaptation selected. For example, if a student has chosen to show a plant that can survive being run over by a lawn mower, the answers here might include one or more of the following suggestions:

- The leaves of the plant all lie flat and very close to the ground.
- The plant is fast-growing and replaces parts that are cut.

Part B: Plant Model and Interpretations

Students will choose one of the plants listed. Models will vary. The model should reasonably illustrate the adaptations that were selected.

Answers will vary, but they should be appropriate to the adaptation selected. For example, if a student has chosen to show a plant that can survive being run over by a lawn mower, the answers here might include one or more of the following suggestions:

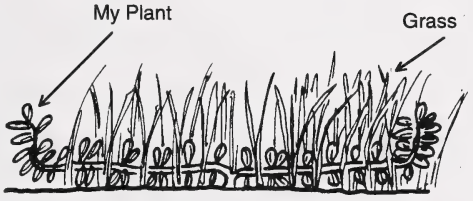
- The leaves of the plant all lie flat and very close to the ground.
- The plant is fast-growing and replaces parts that are cut.

Part C: Explaining Existing Plant Diagrams

Gurpreet's Diagram

Which condition do you think Gurpreet's plant can survive? 1

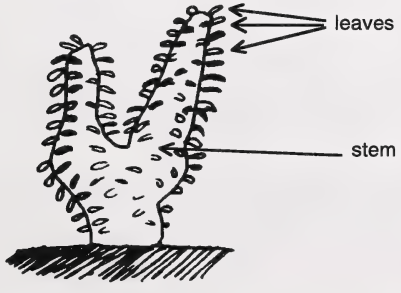
The leaves of the plant are very close to the ground. The plant is fast-growing and replaces leaves if they are cut.



Jennifer's Diagram

Which condition do you think Jennifer's plant can survive? 3

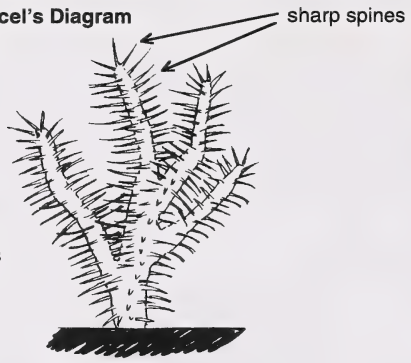
Water could be stored in the thick stems. By having small leaves, the plant does not dry out quickly.



Marcel's Diagram

Which condition do you think Marcel's plant can survive? 4

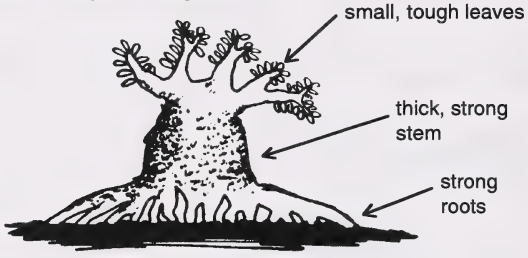
The sharpness of the spines make it undesirable as cattle food. The plant may also cause irritation to the animal if it rubs up against it.



Huynh's Diagram

Which condition do you think Huynh's plant can survive? 3 or 5

If 3 is chosen: Water could be stored in the thick stems. By having small leaves, the plant does not dry out quickly.



If 5 is chosen: The thick roots hold the plant in place during high winds.

Section 4: Activity 4

Note: Students are to do either Part A or Part B.

Part A

The drawings should illustrate the camouflaging of an animal through the use of colour and the use of designs that blend in with the surroundings.

Part B

Comments:

- The learning facilitator should help the student obtain the necessary materials to do this Activity. (The Materials You Need and the Steps to Follow are stated in the student module.)
  If some of the materials listed are not available, students can use their ingenuity to substitute suitable available materials to achieve the same objectives.

- The learning facilitator should check to see that steps 1 to 6 were properly done.

1. Answers will vary, but they should show evidence of critical thinking about the effectiveness of the camouflage used.

2. Answers will vary, but they should show evidence of critical and creative thought.

Section 4: Follow-up Activities

Extra Help

- The shape of a fish is usually streamlined so that it can pass through water easily.
- Fish have flat tails that help move the fish quickly.
- Fish have fins on the sides (pectoral fins), on the back (dorsal fin), and on the bottom (ventral fin), which helps the fish move in the direction it chooses to go.

Enrichment

Answers will vary. Following are examples of answers that might be given.

- Seed Chosen: Examples: milkweed or dandelion

  Inference: Milkweed can be carried in the wind.

  Supporting Observation: The milkweed seed has many fine hairs that are easily carried by the wind.

- Seed Chosen: Examples: beggars-tick or cocklebur

  Inference: The seed could be carried on animal fur or on clothing.

  Supporting Observation: The seed has many hooks or spines that might stick to fur or clothing.

- Seed Chosen: Examples: acorn or snowberry

  Inference: The seed might be carried by animals that use the seed for food.

  Supporting Observation: A large part of the seed is made up of stored food.

- Seed Chosen: Example: maple

  Inference: As the seed falls from the tree, the wind may carry it.

  Supporting Observation: The large flat surface of the seed may help it be carried in the wind when the seed falls.

Note: The student should now complete the assignment for Section 4 in the Module 1 Assignment Booklet.

Section 5: Behavioural Adaptations

By the end of this section students should be able to identify examples of behavioural adaptations.

Section 5: Activity 1

1. Answers will vary. Examples: hawks, mallards, robins, finches

2. Answers will vary. Example answers are given.

   - There is not much food available in northern areas in the winter, so birds may fly south to find food.
   - The climate in the north is very cold in the winter, so birds may fly south to keep from freezing.

Section 5: Activity 2

Blue Whale: In winter the ice pack will cover the surface of the water. If whales do not migrate, they will not be able to reach the surface and will not be able to breath. They will die as a result.

Yellow-rumped Warbler: If the warblers do not migrate they will starve. All the moving insects that the warbler eats are not available during the winter.

Section 5: Activity 3

1. The predictions are likely based on his knowledge about hibernation. Since a hibernating animal does not need much energy, its body processes would be slowed down.

2. a. 160 beats per minute
   b. about 25–30 beats per minute
   c. about 35°C
   d. about 2°C

3. The graphs show a sudden drop in heart rate and body temperature in October. During the winter months the heart rate remained slow and the body temperature remained low. In spring (April) the body temperature and heart rate increased suddenly.

Section 5: Follow-up Activities

Extra Help

1. Humans keep their body temperature at 37°C by shivering and keeping active when they are cold. Other suitable answers include putting on warm clothes, exercising, turning up the room temperature, and drinking hot drinks.

2. Humans keep their body temperature at 37°C by sweating when they are too hot. Other suitable answers include cool showers, cold drinks, wearing fewer clothes, and using a fan to evaporate moisture on skin.

Enrichment

1. Name of Animal: Example: frog

   Behavioural Adaptation: Some frogs bury themselves in ponds all through the winter and emerge in the spring.

2. Name of Animal: Example: ants

   Behavioural Adaptation: Ant nests often have sections that are deep underground. These sections do not freeze during the winter months.

   Answers will vary. Other examples may include animals such as dragonflies, turtles, snakes, and houseflies. These lie in the sun in cool weather to raise their body temperture so they can become active enough to hunt for food. If daytime temperatures become too hot, cold-blooded animals such as snakes and turtles may avoid the sun by moving into burrows in cooler earth, or seeking water or shade to keep cool.

> Note: The student should now complete the assignment for Section 5 in the Module 1 Assignment Booklet.

Section 6: Stimulus and Response

By the end of this section students should be able to

- identify examples of stimulus-response patterns in the behaviour of organisms
- recognize and describe responses to specific environmental conditions
- distinguish between learned, instinctive, and involuntary responses

Section 6: Activity 1

1. a. STIMULUS → RESPONSE → RESULT
   light from campfire | moths fly towards light | moths are burned in fire

   b. STIMULUS → RESPONSE → RESULT
   light from campfire | moths fly away from fire | moths are not harmed by fire

2. STIMULUS: sunlight coming through a window

   Possible RESPONSES:

   - The plant grows toward the sunlight (window).
   - The plant grows away from the sunlight (window).
   - The plant does not respond to the light.

   Possible RESULTS:
   - plant survives

   or
   - plant dies (because it is not able to make food)

   a. STIMULUS → RESPONSE → RESULT
   sunlight from one side | plant grows toward light source | plant growth is improved

   b. STIMULUS → RESPONSE → RESULT
   sunlight from one side | plant grows away from light source | plant growth is lessened (plant eventually dies)

Section 6: Activity 2

Comments:

- The learning facilitator should check to see that the student is following the proper procedure to measure their pulse rate. (This is outlined in the first step of the Procedure on page 42 of the textbook, *Science Directions 7*.)
- The learning facilitator should supervise the student to check that steps 1 to 6 for this Activity are properly carried out.
- If for any medical reason the student should not exercise or run on the spot, then someone else can do steps 1 to 6 while the student acts as the recorder to record the results.

Observation Chart

Stimulus	Trial One beats per minute	Trial Two beats per minute	Average beats per minute
sitting still			60 - 90
thinking			60 - 90
exercise			90 - 150

typical range

Interpretations

1. Answers will vary.
2. "No" is the normal response.
3. Exercise caused the pulse rate to increase
4. Pulse rates are an involuntary response.
5. I was unable to change my pulse rate. Pulse rate is changed automatically in response to the body's needs.

Section 6: Activity 3

Comment: The learning facilitator should supervise the student to check that steps 1 to 5 are properly carried out.

Observation Chart

Stimulus	Trial One times per minute	Trial Two times per minute	Average times per minute
sitting still			8 - 15
thinking			8 - 15
exercise			20 - 40

typical range

Interpretations

1. Your breathing rate can change automatically, but it can also be changed deliberately.

Section 6: Activity 4

1. The wasp needed to familiarize itself with landmarks around the nesting hole.
2. The researcher was trying to determine if the wasp would return to the circle of pine cones rather than to its nest. If so, there would be evidence that the wasp had memorized the landmarks.
3. It was repeated in order to ensure that the findings were accurate.
4. The researcher was trying to find out whether the wasp used the pine cones or the shape in which they were arranged (circular shape) to find the nest.
5. Hypothesis 1: Digger wasps memorize the shape of the landmark.

   The wasps returned to the circle to find their nests. They did not respond to objects arranged in a triangle.

Section 6: Activity 5

1. The red colour of the belly cause the male stickleback fish to attack.
2. The male wants to keep his mate for himself.
3. STIMULUS → RESPONSE → RESULT
   sight of red belly → chase the fish away → the fish keeps its mate to itself

Section 6: Activity 6

1. The songs that songbirds, such as robins and meadowlarks, sing must be learned.

2. If a young bird is isolated from others of its kind and does not hear its species' song early in life, it will not be able to communicate effectively.

Section 6: Follow-up Activities

Extra Help

1. __c__ it is snowing outside
   __f__ a bright light flashes on
   __a__ the alarm clock rings
   __e__ the garbage begins to smell
   __b__ you touch a hot object
   __d__ the doorbell rings

2. a. STIMULUS: A hunter approaches the deer.

   b. Possible RESPONSES:

      - The deer ignores the hunter approaching.
      - The deer moves away to a remote area.

   c. Possible RESULTS:

      - The deer is shot.
      - The deer grazes safely.

   d.

STIMULUS	→	RESPONSE	→	RESULT
A hunter approaches.		The deer ignores the hunter.		The deer is shot.

   e.

STIMULUS	→	RESPONSE	→	RESULT
A hunter approaches.		The deer moves away to a remote area.		The deer grazes safely.

Enrichment

1. STIMULUS: The boy touches a hot stove.

2. Possible RESPONSES:

   - The boy pulls his hand away.
   - The boy leaves his hand on the stove.

3. Possible RESULTS:

   - The boy's hand is not seriously harmed.
   - The boy's hand is burned badly.

4. a. STIMULUS → RESPONSE → RESULT
heat of stove | boy pulls hand away | hand is not seriously harmed

b. STIMULUS → RESPONSE → RESULT
heat of stove | boy leaves hand on stove | hand is burned badly

Comment:

If the student experienced any difficulty with the Enrichment, the student should then review the Extra Help.

5. a. Stimulus: Changes in the amounts of carbon dioxide in your system are detected by receptors in your body.

b. Response: Certain muscles in your chest will contract to force carbon dioxide out of your lungs when receptors sense that there is too much carbon dioxide in your body.

Note:

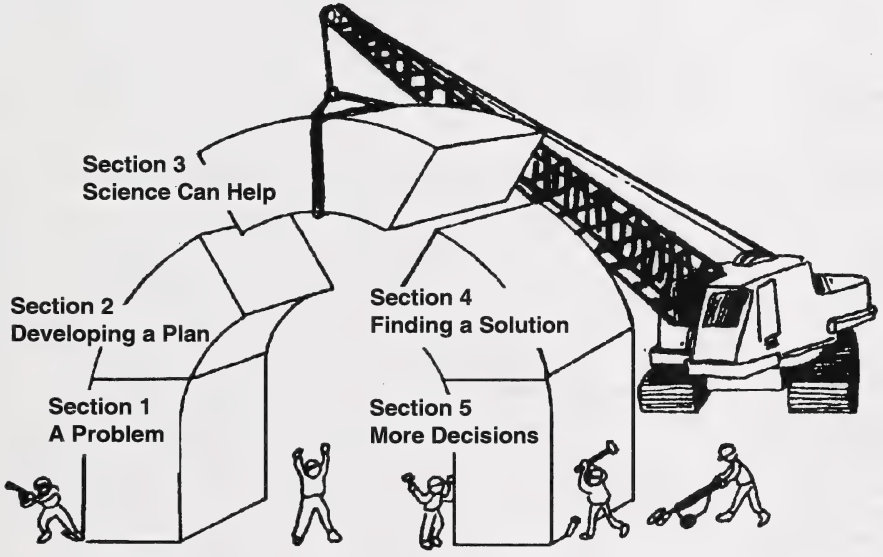
1. The student should now complete the assignment for Section 6 in the Module 1 Assignment Booklet.
2. Check to see that all assignments have been completed and that all written work is done neatly in blue or black ink. Diagrams may be left in pencil.
3. The completed Assignment Booklet should now be submitted to the Alberta Distance Learning Centre for correction. The student can proceed with the next module while waiting for the return of the Assignment Booklet.

Module 2 - Structures and Design: Overview

The major emphasis of this module is on science and technology. However, opportunities are also present to support learning regarding the nature of science and the relationships between science, technology, and society.

In Module 2, students will look at structures and at how they are put together. They will compare structures made by people with structures in the natural world. While examining structures and their design, students will also consider the function of the overall structure, as well as the function of individual components.

Module 2 will give students the opportunity to plan and build some structures on their own. They will discover how to choose the best materials for making the structures and why one design is stronger than another. By doing the activities in this module, students will develop the skills of technological problem solving. They will come to appreciate that often there is more than one solution to a problem and that there is value in considering alternative approaches. Social, environmental, and aesthetic considerations are also taken into account in this module.



Evaluation

The student's successful completion of all assignments will depend on practice obtained while doing the various activities. Many choices of activities have been provided so that students have some control over their own learning.

The following distribution of marks will determine the student's grading for this module.

Section 1 Assignment	**17 Marks**
Section 2 Assignment	**14 Marks**
Section 3 Assignment	**22 Marks**
Section 4 Assignment	**21 Marks**
Section 5 Assignment	**26 Marks**
TOTAL	**100 Marks**

Each module in Science 7 is worth 10% of the student's course mark. The final test, based on the learnings from all six modules, is worth 40% of the total final grading.

Materials Needed for Module 2

Comment: For a complete overview of the materials needed for Module 2 and how the topics are developed, it may be helpful to preview the contents of Module 2. In some cases if the materials suggested are not readily available, the learning facilitator may be able to substitute suitable materials for the student, so that the activities can be completed successfully.

The materials needed for Module 2 and the activities in which they are to be used are as follows:

Section 1: Activity 1

- nine index cards (3 blue, 3 yellow, and 3 red)
- a block labelled *model boat*, or a toy boat
- two other blocks of wood (These are to represent the banks of the river.)
- eight test bags (Each bag contains 100 g of sand or other suitable substance.)

Section 3: Activity 1

- dried spaghetti
- plastic straw
- thin wooden dowel
- two blocks of wood
- force meter
- metre stick (or tape)
- safety glasses

Section 3: Activity 2

- force meter
- masking tape
- strips of poster paper cut into 7 cm × 21 cm strips
- two blocks (to form end supports)

Section 3: Activity 3

Part A

- pleated straws
- two wood blocks

Section 3: Activity 5

- two wooden coffee stir sticks, or strips of stiff cardboard, with holes near ends
- a brass paper fastener
- two wood blocks
- a length of string (about 30 cm)
- tape

Section 3: Activity 6

- nine wooden coffee stir sticks with holes near the ends
- six brass paper fasteners
- a wood dowel (20 cm or longer)
- two wood blocks

Section 3: Extra Help

- 30 cm lengths of four different types of thread
- wooden block 30 cm or longer
- bag or plastic container to hold the load
- 100 g bags of sand

Section 4: Activity 1

- pins
- spaghetti
- straws
- thin wood dowels
- thread
- glue

Section 4: Extra Help 1

- strips of stiff cardboard
- paper fasteners or pins

Section 4: Extra Help 2

- two sheets of paper or thin cardboard (about 28 cm × 22 cm)
- eight 100 g bags of sand
- two wooden blocks

Section 5: Activity 1

- two drinking straws
- two small containers (250 mL)
- a marble
- scissors
- a ruler
- adhesive tape
- sand
- five metal paper clips
- a cardboard tube
- a sheet of stiff cardboard (20 cm × 20 cm)
- two large rubber bands
- modelling clay
- water

Media (Optional)

The following two video programs are suggested if the students are to use the optional media learning pathways in Module 2.

Section 3: Activity 3

Part B: *Science of Architecture: Part 2 Push or Pull* (30 minutes)

Section 5: Activity 2

Part B: *Science of Architecture: Part 1 Loads – Dead or Alive* (first 10 minutes)

Note: Videocassettes used in this course may be available from the Alberta Distance Learning Centre, or call your local school authorities.

Section 1: A Problem

By the end of this section students should be able to

- demonstrate a systematic way to solve practical problems
- describe the type of problems that technology can solve
- describe why creativity and inventiveness are useful in solving problems

Section 1: Activity 1

Comments:

- In this activity students are to solve a problem. They are to build a prototype of a bridge that will meet the specifications as stated in the Module Booklet. Check to see that the student has understood the problem, has kept notes of what was done during construction, and has built the prototype to meet the specifications listed.

- The three colours of index cards is to allow the student to explore several trials, if desired. Only three index cards are required for the actual construction of the bridge. If index cards are unavailable, thin cardboard sheets may be used instead.

- Books can be substituted for blocks of wood to form the banks of the river.

- The eight 100 g test bags should be made and saved for use in later activities. If sand is not available, rice, salt, sugar, grain, etc. can be used instead. A kitchen scale, spring scale, or balance scale can be used to measure out 100 g of sand or other substance for each test bag. Small freezer bags or sandwich bags could be used to contain the sand.

1. Answers will vary. Students should show one or more rough drawings that represent their first ideas.

2. Answers will vary. Students will describe in their own words what they think to be important in selecting a design. The additional points under the question may provide some guidance to students. Answers should show evidence of critical thought and might deal with one or more of the following considerations:

   - availability of materials
   - extent to which designs meet specifications
   - ease of construction
   - similarity to designs observed elsewhere

3. Answers will vary. Students should be encouraged to use a variety of sources for their ideas (e.g., books and other print materials, television, designs of actual bridges).

4. Answers will vary. Students should note changes they made to improve their designs.

5. Answers will vary. Answers should indicate that the bridge was built according to design or that the student had tried a new idea that appeared worth testing.

6. Answers will vary. It is satisfactory to work toward the basic requirements or to go beyond the requirements.

7. Answers will vary. Drawings and descriptions should show plausible methods of design.

Note: The student should now complete the assignment for Section 1 in the Module 2 Assignment Booklet.

Section 2: Developing a Plan

By the end of Section 2 students should be able to

- compare design in the natural world and in the manufactured world
- describe a strategy for approaching a technological problem
- describe the design of a structure
- infer the function of a structure

Section 2: Activity 1

1. a. to c.

Natural Structure	Manufactured Structure (made by people)	Design in Common
plant seed with extended fine hairs	parachute	both have parts that are designed to catch the wind
elbow	hinge	both involve movement between joined sections
spider web	net	both are used to catch prey while moving by
mushroom	umbrella	both shed water to the side
flower	satellite receiver dish	both are open structures that are curved upward at the edges
tree	clothes tree	both have main stems and branches

2. Something made by people or not found in the natural world is manufactured.

3. a. Yes or no are both acceptable.

   b. If yes, the explanation should focus attention on the strong similarities.
   If no, the explanation should focus on differences.
   Look for evidence of critical thought in the student's answer.

Section 2: Activity 2

1. Check to see that the student had worked with the tangram pieces and practised making different designs such as a duck, sailboat, kangaroo, and watering can that were illustrated in the textbook.

2. Answers will vary. The overall approach should be similar to what was shown in the previous examples.

Section 2: Activity 3

1. Answers will vary. The following answers are examples.

Function	Structure 1	Structure 2
communicating	pen	telephone
supporting	chair	bookcase
containing	cup	box
lifting	crank	elevator
fastening	belt	staple
sheltering	house	tent
transporting	truck	wagon
separating	sieve	egg separator
breaking	axe	nutcracker

Section 2: Follow-up Activities

Extra Help

1. Answers will vary. Students are to give three answers. The following answer is an example.

Structure	Part (s)	Shape	Quantity
Skateboard	wheels axles board	circle cylinder oval	4 2 1

2. Answers will vary, but they should be consistent with the examples given in the previous chart.

3. Answers will vary.

4. Answers will vary.

5. Answers will vary. Students should show evidence of critical thought.

Enrichment

Note: Students are to do either **Part A or Part B.**

Part A: Field Trip and Part B: Research

Note: Students are to visit the site of three local bridges (Part A). If this is not possible, they are to look through magazines or books to find examples (Part B).

1. Students should attach snapshots or sketches of the actual bridges (Part A) or photographs or sketches from books or magazines (Part B). Illustration of different kinds of bridges should be encouraged.

2. Answers will vary. For example, a bridge might serve as an overpass that carries one lane of traffic over another.

3. Answers will vary. Answers should show evidence of critical thought and careful observation.

4. Answers will vary. Students should show evidence of critical thought and careful observation.

5. Answers will vary. Students should indicate some aspect or feature of the designs that might be useful in their own bridge.

Note: The students should now complete the assignment for Section 2 in the Module 2 Assignment Booklet.

Section 3: Science Can Help

By the end of this section students should be able to

- demonstrate how to test the strength of material
- demonstrate how to test the strength of different shapes of structures
- describe all forces as compression, tension, or a combination of compression and tension
- explain the advantages and disadvantages of structural design based on scientific information
- describe how scientific knowledge can help solve technological problems

Section 3: Activity 1

Comments:

- If a force meter is unavailable students can use a small light container and add masses such as marbles or sugar cubes to the container until the beam breaks.

- The wooden dowel should be approximately 2 mm or 3 mm in thickness.

- If wooden dowels are unavailable then suitable substitutes may include plant supports, skewer sticks, or thin twigs.

- The charts may be extended to accomodate extra observations if necessary.

1. Answers will vary. Normally the deflection will increase by even intervals as similar units of force are added.
2. Answers will vary. Check the answer with the chart.
3. Answers will vary. Check results with those in the chart.
4. Answers will vary. The deflections will be much smaller than that of the spaghetti.
5. Answers will vary. Check with the information in the chart.
6. Answers will vary. Check with the information in the chart.
7. Answers will vary. Deflection will be intermediate between those found for the spaghetti and those found for the wood dowel.
8. Answers will vary. Check with the information in the chart.
9. Answers will vary. Check with the information in the chart.
10. wood dowel (strongest), plastic straw, spaghetti (weakest)
11. a. Yes

    b. The force meter provided a means of comparing the effects of the same force on different material, or for the same amount of force, some materials bent more than others.

Section 3: Activity 2

Comments: Some of the questions in Activity 2 require the student to perform certain observations, or constructions, while the student follows the instructions to complete questions 1 to 12.

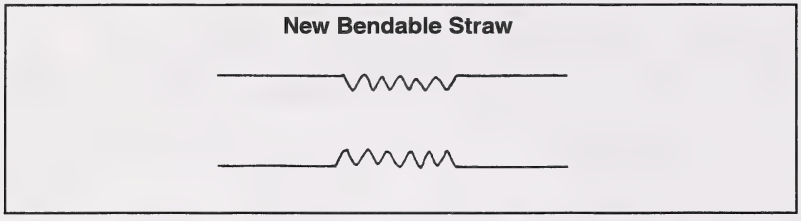
1. The student must examine the examples.
2. Sketches of designs will vary.
3. Answers will vary.
4. Make the five shapes, using one strip of cardboard for each shape. Fold, bend, and tape the cardboard, if necessary, to retain the desired design.
5. Place the two wood blocks 18 cm apart. Set the flat beam on the supports to span the gap.
6. Use tape to attach the force meter onto the middle of the beam.
7. Gently apply downward force onto the beam.
8. Record the force required to cause a deflection of 1 cm. (If the shape permanently distorts before a deflection of 1 cm, record the force used just before the beam broke.)
9. Repeat the preceding steps using the other beams.
10. Answers will vary.
11. Answers will vary. Of the shapes given, the box shape will usually be strongest.
12. Box beams could be used in that structure, or students may give another acceptable answer based on their observations.

Section 3: Activity 3

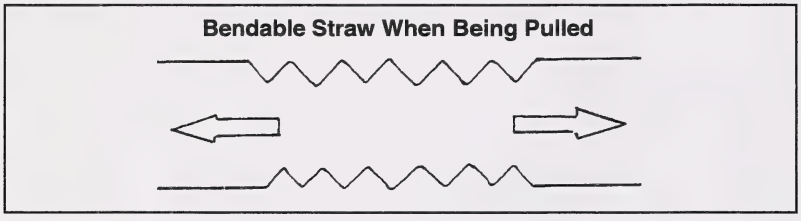
Note: Students are to do either Part A or Part B.

Part A: Using Pleated Straws

1.

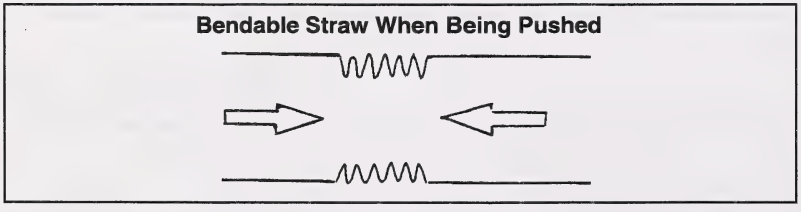


2.



3. It is stretched out. (It lengthens.)

4.



5. It is squeezed together. (It becomes shorter.)

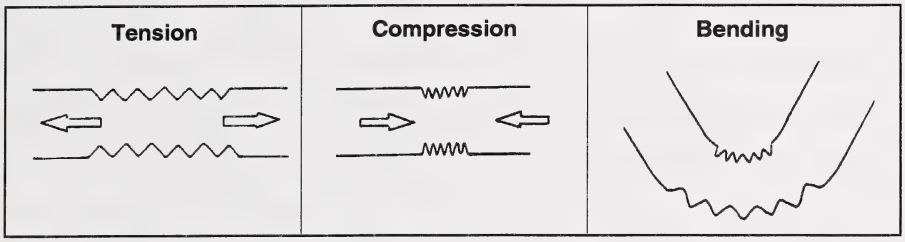
6. Compression is a pushing force. Tension is a pulling force.

7. Compression causes something to be squeezed together; tension causes something to be stretched.

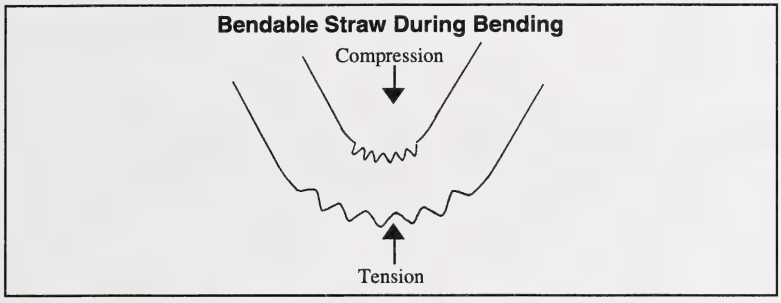
8. Use a new pleated straw to make a beam across two wood blocks.

9. Push down with your finger near the pleated section. Observe the appearance of the pleats. Look carefully at the top and the bottom of the pleated section. You have applied a bending force.

10.



11.



12. a. compression

b. tension

c. both compression and tension

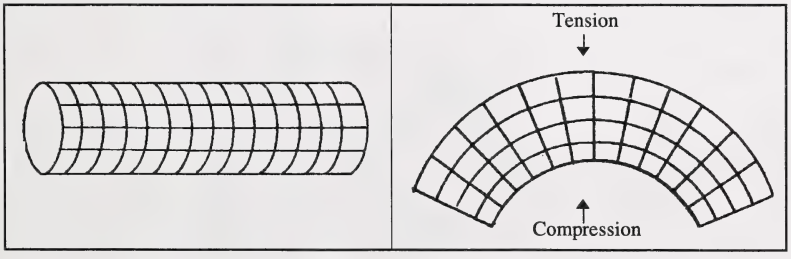
Part B: Videocassette

1. Compression is a pushing force (or a change in material that results from a pushing force).

2. Tension is a pulling force.

3. When something bends, one side is under tension; the opposite side is under compression.

4.



5. When something is bent, part of it is squeezed together. This part is said to be compressed. The opposite side is being pulled apart. This part is under tension.

Section 3: Activity 4

1. A greater load can be supported by beam (b).

2. The load is being supported by a greater thickness of wood.

3. • AB 8.7 cm • CD 8.7 cm • EF 8.7 cm

4. • AB 7.5 cm
   • CD 9.8 cm Line AB is shorter than EF, while line CD is longer than EF.
   • EF 8.5 cm

5. CD

6. AB

7. Line EF is not under compression or tension. If you measure this line it does not change when the weight is added.

8. They have less mass than solid beams. As a result they are less expensive. Also, with less mass of their own to support, they can support a greater load.

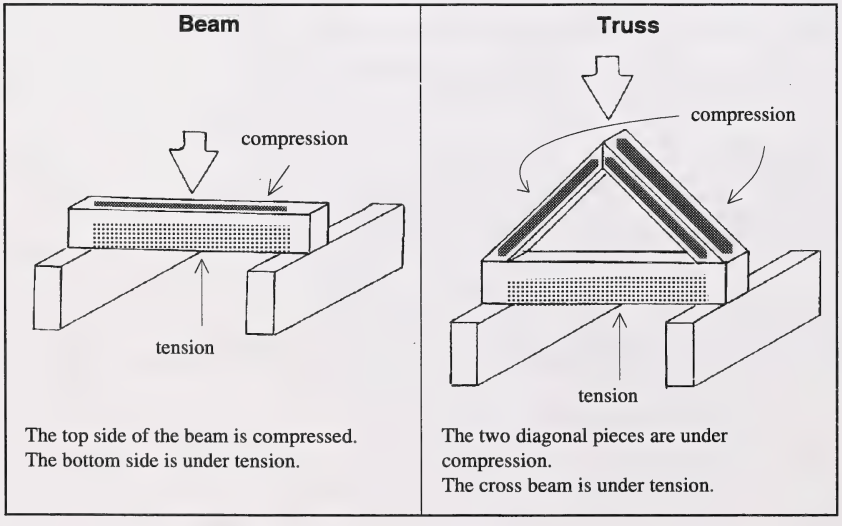
Section 3: Activity 5

Comments:

- If wooden stir sticks with holes near the ends are not available, the learning facilitator may be able to drill holes in ordinary ice cream sticks. Or, strips of stiff cardboard, approximately the same size as wooden stir sticks, with holes punched near the ends could be used instead. If making holes is not practical, then small nails or pins can be used to hold the stir sticks or stiff cardboard together.

- This activity is a construction activity. Check to see that the student has followed steps 1 to 10 and has understood the results of the observations made, especially for steps 3, 7, and 10. Check the answer for the optional step 11, if the student chose to do it.

Step 11: (Optional)



The top side of the beam is compressed.
The bottom side is under tension.

The two diagonal pieces are under compression.
The cross beam is under tension.

Section 3: Activity 6

Comments: Check to see that the student has understood the constructions for steps 1 to 4. Then check the answers to the questions.

1. Warren trusses are commonly used in bridges and to support roofs.
2. Without this bracing, the trusses might fall over. (The structure would not be stable.)
3. This is often used below roofs and under floors.

Section 3: Activity 7

1. Answers will vary (e.g., elbow).
2. Answers will vary.
   a. Answers will vary (e.g., brake handles are similar). They bend in one direction.
   b. With your elbow, your arm is not pushed back by a spring.
3. hip joint
4. crankshaft
   a. They both swing around, at least a bit.
   b. The hip joint does not go all the way around in a circle as does the crankshaft.

Section 3: Follow-up Activities

Extra Help

Comment: The experiment that the student is to do in this Extra Help is based on the information given for Activities 2–9 on page 98 of *Science Directions 7.*

Observations: Answers will vary.

1. Answers should be consistent with the data in the observation table.
2. Hang paper from a clamp (or otherwise fasten the top). Attach tape in several layers to the bottom and make a hole to insert hanging weights or a force measurer. Load the paper until it breaks.

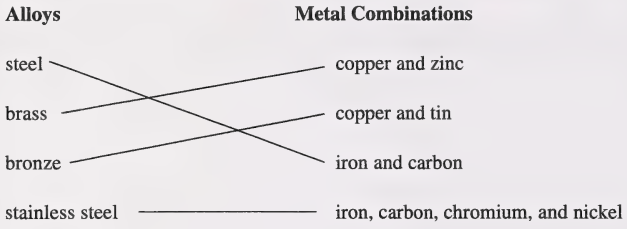
3. A pencil would have a greater compressive strength; a string will resist a pull but it will not resist a push.

Enrichment

1. Answers will vary. Some clips will break after being bent just a few times; others can be bent ten to twenty times.

2. It is the loss of strength of a material due to repeated stress, such as bending.

3.



Note: The student should now complete the assignment for Section 3 in the Module 2 Assignment Booklet.

Section 4: Finding a Solution

By the end of this section students should be able to

- solve a practical problem in a planned way
- develop a prototype as a means to test their ideas
- use knowledge of compression and tension to help identify and evaluate aternative designs

Section 4: Activity 1

Comments:

- In this activity the student's task is to find a solution to a problem in a systematic way by using science information to help them. They will build a prototype bridge but with different specifications than those used in Section 1 to solve the problem. The specifications are stated in the Module Booklet.

- Check to see that the student has understood the problem and has kept notes while progressing through the problem-solving steps.

- Check to see that the prototype the student constructed meets the specifications listed.

1. Answers will vary. As in the earlier section, students should be encouraged to use different sources for their ideas and to be critical thinkers when it comes to selecting materials.

2. Answers will vary. Students should note changes to their design and comment on how they tested it. Diagrams as well as explanations might be given here.

3. Answers will vary. Answers should indicate that the bridge was built according to design specifications, or that the student had tried a new idea that appeared worth testing.

4. Diagrams and descriptions will vary. Drawings and descriptions should show plausible methods of design.

5. This part is optional.

Cost of Materials

Material	Cost	Number Used	Money Spent on This Material
pins	$1 each	Answers will vary.	
straws	$5 each		
thread	$1 for 30 cm		
spaghetti	$1 each		Items in this column are the product of items in the previous two columns.
wood dowel	$10 each		
glue	$1 for each mL		
Total Cost of Materials			

Section 4: Follow-up Activities

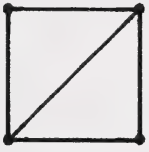
Extra Help

Why Be a Square When You Can Be a Triangle?

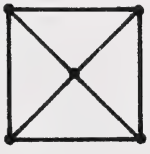
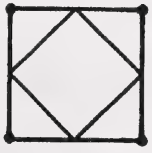
Comment: The experiment that the student is to do in this Extra Help is based on information given in Activity 2-13 on page 112 of the textbook. This hands-on activity helps students learn how to achieve rigidity in structures.

Step 1: Without any reinforcement the square frame is not very rigid.

Step 2: One way the square frame may be made more rigid is by putting the long strip of paper diagonally from corner to corner, forming two equal-sized triangles. For example:



Step 3: Answers may vary. One way might be to attach one end of each short strip of cardboard to each corner and then attaching the other ends of the short strips with a pin in the center of the frame, or another way might be to place one short strip of cardboard across each corner. For example:

 **or** 

Step 4: One way might be to place one strip from each of the bottom corners to join the top strip of the rectangle at the center forming three triangles. For example:

Making Rigid Sheets

Comment: This Extra Help is based on information given in Activity 2-14 on pages 114 and 115 of the textbook.

1. If an indentation or bend is made in the paper, it will stand upright; otherwise, it will fall over.
2. a. This design does not fall over. (It may if the paper is very thin relative to the overall size of the sheet.)
   b. The thicker the paper, the less likely it is that the structure will fall over.
3. a. Not likely – not unless it is very heavy paper.
   b. It should if the folded paper is placed between the blocks.
   c. Answers will vary.
4. Answers will vary. Students should be encouraged to apply critical and creative thought.

Enrichment

Comments: This Enrichment is based on information given in Activity 2-16, on pages 119 to 121 of *Science Directions 7*.

1. The number of traffic jams and accidents led to the call for a new bridge. The traffic loads had increased greatly since the original bridge was built.
2. Students may state any three of the following five questions.
   - Which material takes longer to assemble and join together?
   - Which material is more expensive?
   - How much of each material would be needed for the bridge?
   - Does one material have to be transported a longer distance than the other?
   - Are the construction workers in the area more experienced using one material than the other?
3. Answers will vary.
4. Examples:
   - cost of material
   - ease of assembly
   - amount of material needed
   - supply source for materials
   - skills of available construction workers

Note: The student should now complete the assignment for Section 4 in the Module 2 Assignment Booklet.

Section 5: More Decisions

By the end of Section 5 students should be able to

- recognize that the selection of materials and a design is based on many considerations
- identify differences in design to accommodate specialized needs or environmental conditions

Section 5: Activity 1

Comments: In this activity students are to use a number of simple objects from a list of materials to design structures to carry out different tasks. They are to think about how they might use each object, how they might change its shape, or how they might combine it with other objects. They should plan their designs and change them if they don't work at first. Remind students not to worry about making mistakes as they can learn from mistakes. The world's greatest inventors have many more failures than successes. Encourage students to be willing to try to solve the tasks. There are several ways each task can be solved. Students' answers should show evidence of both creative and critical thought. The structures they design need not be elaborate, just effective.

Developing Your Designs

1. First Task Chosen: Answers will vary. For example, if Task A is chosen, the materials and diagram should illustrate an effective means of transferring sand from one container to another.

   Second Task Chosen: Answers will vary. For example, if Task B is chosen, the materials and diagram should illustrate an effective means of transferring water from one container to another.

   Third Task Chosen: Answers will vary. For example, if Task C is chosen, the materials and diagram should illustrate an effective means of separating a ball of clay into three parts.

Comments: Many designs and answers are possible for each of the tasks. Students will come up with some good, unique, ingenious ways to accomplish the tasks. Encourage original, creative designs. Following are only a few possible designs for Tasks A to E.

Task A: The designs may range from being simple to being very complex. Spoons could be made from pieces of cardboard or from modelling clay to do the job. Or, students may use the cardboard tube to build supporting structures to hold one container 15 cm above the other one, then the cardboard sheet could be used to make a sliding door to release sand from one container to another.

Task B: Some of the same ideas as used for Task A may apply here. One container may be raised and a straw poked through the bottom or side of the container and modelling clay could be used as a seal to prevent unwanted leaks. Water could then flow through the straw from one container to the other one.

Task C: Strips of cardboard or paper clips can be fastened across the cardboard or cup to form cutting edges to cut the modelling clay into three equal parts.

Task D: Students could pour sand into the tube and continuously prod the marble to keep it on top of the sand, or they could use the straws and elastic bands to make a tweezer-like device to lift the marble, or they could attach some modelling clay to the end of a straw and lift the marble with modelling clay.

Task E: Modelling clay could be used to hold a straw upward against the ramp and the marble could be attached to the other end of the straw halfway up the ramp, or a piece of cardboard could be folded and attached to the center of the ramp to hold the marble, or an elastic band could be taped to the top edge of the ramp with the marble being held halfway up the ramp by the other end of the rubber band.

Evaluating Your Design

2. Answers will vary. Answers should show evidence of a realistic critical appraisal of the work done.

3. Answers will vary. Answers should show evidence of both creative and critical thought.

Section 5: Activity 2

Note: Students are to do either Part A or Part B.

Parts A and B both involve looking at the functions of different designs.

Part A requires answering questions about diagrams. Part B requires viewing a videocassette called *Science of Architecture, Program 1: Part 1 Loads – Dead or Alive* (first ten minutes) and answering questions about diagrams.

Part A

1. • House on Stilts: support for house built over water (or to keep the house above water)
   • Travel Mug: container for liquid; it will resist spilling when moved
   • Netting over Bed: protection from insects
   • Rubber Mallet: striking an object without damaging the object
   • Box with Handle: carrying tray for small objects
   • Sieve: separation of fine material from course material

Part B

View the videocassette called *Science of Architecture, Program 1: Part 1 Loads – Dead or Alive*. Watch from the beginning to just after the discussion about the locomotive (about ten minutes). The last sentence is "So the design of any form of structure depends not only on what it is doing or being used for, but also where it is."

2. • Manhole Cover on a Road: The cover can be placed on at any angle and will not fall in.
   • Stop Sign: The height of the sign can be set to a standard height.
   • Roof over the Door of a House: The roof keeps one dry when entering or leaving the house.
   • Covered Vehicular Bridge: The roof keeps snow off the bridge.

3. a. Steel (usually) is used to make a truck The cost is lower.

   b. Stainless steel is used to make cutlery. It is easy to keep clean and is very durable.

Section 5: Activity 3

Note: Students are to do either Part A or Part B.

1. Answers should show evidence of criticial thought regarding conditions that are different on Earth and in space.

   Considerations might include:

   - differences which result from the absence of gravtitational force or from low gravitional forces
   - differences which result from the need to carry all materials required within the spacecraft, including air and water
   - differences which result from the need to work in confined spaces

2. Answers should show evidence of consideration of each of the three factors mentioned in the instructions; i.e.:

   - human needs
   - environmental factors
   - cost considerations

   Answers may focus on the overall design of the spacecraft or on particular portions of the spacecraft.

Section 5: Follow-up Activities

Extra Help

1. a. Answers will vary; e.g., strength, weight, cost, durability.

   b. Example answer: Strength is an important consideration as the canoe may occasionally come up against rocks.

   c. Example answer: weight

   d. Weight is an important consideration because the canoe may have to be carried for long distances.

2. The following answers in the chart are examples.

Material	Property	Function
glass	transparent	windows
rubber	flexible	seal around window
wood	strong but light	chopsticks
paper	very light	kites
metal	strength	car frame
cloth	flexibility	covering material

Enrichment

1. Design a, b, or c are all acceptable.

2. Answers should indicate evidence of critical thought with reference to the criteria listed.

Note: 1. The student should now complete the assignment for Section 5 in the Module 2 Assignment Booklet.

2. Check to see that all assignments have been completed and that all written work is done neatly in blue or black ink. Diagrams may be left in pencil.

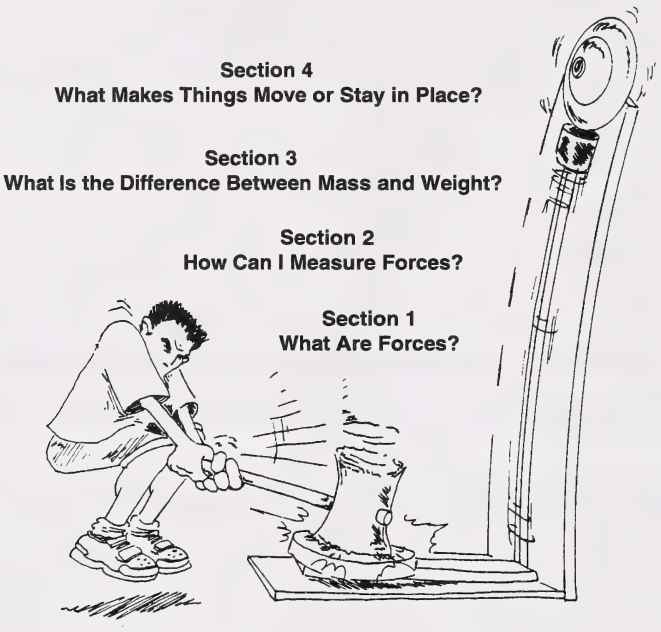
3. The completed Assignment Booklet should now be submitted to the Alberta Distance Learning Centre for correction. The student can proceed with the next module while waiting for the return of the Assignment Booklet.

Module 3 – Force and Motion: Overview

The major emphasis of this module is on the nature of science. For the most part, the module uses an observational and experimental approach, but at the same time many of the practical applications support the other two emphases of the Science 7 program.

Module 3 provides students with the opportunity to study a variety of forces and to examine the effects of these forces on objects and materials. Students will learn how to recognize and measure forces within different systems and in different applications. A study of the causes and effects of friction and a study of motion in space are also part of Module 3.

From the study of Module 3, students will see how forces act on all things and how forces affect them every day of their lives.


Section 4
What Makes Things Move or Stay in Place?
Section 3
What Is the Difference Between Mass and Weight?
Section 2
How Can I Measure Forces?
Section 1
What Are Forces?

Evaluation

The student's successful completion of all assignments will depend on practice obtained while doing the various activities. Many choices of activities have been provided so that students have some control over their own learning.

The following distribution of marks will determine the student's grading for this module.

Section 1 Assignment	**25 Marks**
Section 2 Assignment	**20 Marks**
Section 3 Assignment	**20 Marks**
Section 4 Assignment	**35 Marks**
TOTAL	**100 Marks**

Each module in Science 7 is worth 10% of the student's course mark. The final test, based on the learnings from all six modules, is worth 40% of the total final grading.

Materials Needed for Module 3

Comment:

For a complete overview of the materials needed for Module 3 and how the topics are developed, it may be helpful to preview the contents of Module 3. In some cases if the materials suggested are not readily available, the learning facilitator may be able to substitute suitable materials for the student, so that the activities can be completed successfully.

The materials needed for Module 3 and the activities in which they are to be used are as follows:

Section 1: Activity 2

Part A

- water
- pail or plastic container (3 to 5 L)
- table tennis ball or other air-filled ball
- steel ball or large marble

Part B

- penny
- scissors
- paper

Part C

- paper clip
- penny
- index card
- magnet

Part D

- paper
- wool or fur
- unused plastic comb or plastic rod
- scissors

Part E (Optional)

- metre stick
- rubber ball
- rigid foam ball

Part F

- piece of rug or piece of heavy cloth
- piece of wood
- two bricks or other object with rough surface

Section 1: Extra Help

Elastic Forces:

- rubber band
- ruler
- 100 g mass

Comments:

If a 100 g standardized mass is not available, students can use the 100 g test bag, containing sand or other suitable material, that they prepared for Module 2.

Magnetic Forces:

- paper clip
- thread
- tape
- magnet

Buoyant Forces:

- several pennies
- large container (4 L)
- water
- small plastic lid

Section 2: Activity 1

Note: Students will need to select from available household materials to design and build a force meter.

Section 2: Activity 2

Part B

- force meter (spring scale) calibrated in newtons

Section 2: Extra Help

- spring scale calibrated in newtons
- 1000 g mass
- two magnets
- paper clip

Comments:

If a 1000 g standardized mass is not available, students can use a substitute such as a 1 kg bag of sugar, salt, flour, etc. Remember, a 1 kg bag of a substance will likely have a mass slightly more than 1 kg because the mass of the packaging material is included.

Section 2: Enrichment

- large container (about 4 L)
- spring scale (force meter) calibrated in newtons
- water
- string
- stone
- three objects of your choice

Section 3: Activity 1

Note: Students should be encouraged to do Part A. However, in circumstances where it is not possible to obtain some of the following materials, students should do Part B, which does not require any materials.

Part A

- spring scale
- balance scale
- set of standard masses calibrated in grams
- apple
- eraser
- book
- three objects of your choice

Section 4: Activity 2

- index card (or piece of heavy paper)
- penny
- water glass or beaker

Section 4: Activity 4

- two bricks or other small heavy flat objects with rough surface
- spring scale calibrated in newtons
- string
- piece of wood (30 cm × 50 cm)
- piece of linoleum (30 cm × 50 cm), or other smooth surface
- cooking oil

Section 4: Activity 6

Note: Students are to do either Part A or Part B.

Part A

- sheet of stiff cardboard (10 cm × 20 cm)
- marbles (25 or more)
- wind-up or battery-powered toy car or truck

Part B

- two small (5 cm) binder rings
- a long balloon
- string
- tape
- two chairs
- spring clip

Section 4: Extra Help

- table tennis ball
- golf ball

Comments:

In place of a table tennis ball and golf ball, other objects of similar size but different masses can be used. For example, a glass marble and steel ball bearing; or a regular tennis ball and a baseball will work well.

Section 4: Enrichment

Part B (Optional)

- 15 cm copper pipe or PVC tubing with the ends smoothed
- 100 g of metal washers
- fishing line or strong string
- one-hole rubber stopper
- two paper clips

Section 1: What Are Forces?

By the end of this section students should be able to

- infer that a force is being applied to an object by observing its movement
- describe the direction of a force
- identify examples of gravitational, magnetic, frictional, buoyant, and electrostatic forces
- predict the effects of forces

Section 1: Activity 1

Note: Students are to do either Part A or Part B.

Part A

Comments:

All answers for the questions in Part A should be based on the illustrated material on pages 142 and 143 of *Science Directions 7*.

1. Answers will vary. The following three answers are examples:

   - A baseball bat hits a ball, driving it forward.
   - The water toy is being pushed ahead by the pressure of the child's hands against the water.
   - A skateboarder does a hand-stand. The skateboarder's hand pushes against the hill inside the track.

2. Example answers:

   - The parachutist pulls down the parachute while falling.
   - The kite-flyer pulls on the string.
   - The parachutist on the ground pulls the parachute toward herself or himself.

3. a. Example answers:

   - The parachutist is pulled down by gravity.
   - The people on the trampoline come back down.
   - Rocks fall after sliding over a cliff.

   b. The force is acting downward.

4. a. Example answers:

   - The inflatable toy dinosaur floats on the water instead of sinking.
   - The airplane flies instead of falling to the ground.

   b. The force is acting upward.

5. Example answer: The person bouncing from the trampoline does so because of the springiness of the trampoline's surface.

6. Example answer: The girl who has just landed on the water makes a big splash as the water slows her fall.

7. Example answers:

   - The trees are leaning over in the wind, showing that there is a force pushing them sideways. There must therefore be a force stopping the trees from falling over.

   - The kite-flyer is leaning back to keep the kite from flying away.

8. Example answer: The water from the stream falls as it comes over the cliff.

Part B

Answers will vary. They will be similar to ones given in Part A but will be based on what students see around them rather than what is shown in the picture.

Section 1: Activity 2

Note: Students are to do all of Parts A, B, C, D, and F. Part E is optional.

Comments:

Students might find it helpful to refer to the photographs on pages 144 and 145 of the textbook, *Science Directions 7*, to help them complete Parts A to F.

Part A

Observations

Type of Ball	Observations When Dropped	Observations When Released Under Water
table tennis	The ball stays at the surface.	The ball rises to the surface.
steel	The ball sinks to the bottom.	The ball stays at the bottom.

1. Yes, the table tennis ball dropped to the water. The steel ball dropped to the water and sank.
2. Yes, the table tennis ball rose to the surface of the water.
3. No, there was no sideways movement.

Part B

Observations

Way of Dropping	Observations When Dropped
dropped apart	The penny dropped faster than the paper.
dropped together	The penny and paper dropped at the same speed.

4. Yes, the penny and paper dropped downward.
5. Yes, the paper did not fall as fast when it was not with the penny.
6. No, none of the materials moved sideways.

Part C

Observations

Object	Observations When Magnet Moved
paper clip	The paper clip moved in the same direction as the magnet.
penny	The penny did not move.

7. Yes, the paper clip was pulled downward towards the magnet. The force of gravity may also be mentioned in student answers.
8. Yes, the magnet was pulled upward towards the paper clip.
9. Yes, the paper clip moved sideways.

Part D

Observations

Object	Observations of Pieces of Paper
plastic unrubbed	The paper moved only when it was pushed.
plastic rubbed	The pieces of paper stuck to the comb. (In some cases, the paper pieces may be alternately attracted and repelled.)

10. Answers may vary. In most cases students will not infer a downward force, but the force of gravity on the materials may be mentioned.

11. Yes, the comb picked up pieces of paper.

12. Answers may vary. In some cases the pieces of paper may move sideways, depending on the position of the comb relative to the paper.

Part E (Optional)

Observations

Type of Ball	Height of Bounce
rubber ball	Answers will vary. Some balls will bounce almost to the height from which they were dropped, while others will not bounce as high. If allowed to bounce, each bounce will be less than the preceding one.
rigid foam ball	The rigid foam ball does not bounce, or at best only a very low bounce occurs.

13. Yes, both balls dropped downward to the floor.

14. Yes, the rubber ball bounced back up after hitting the floor.

15. No, there was no sideways movement.

Part F

Observations

Surface Used	Observations for One Brick	Observations for Two Bricks
pushed on rug surface	fairly hard to move	requires more force to move than for one brick
pushed on wood surface	fairly easy to move	requires more force to move than for one brick

16. Answers may vary. In most cases students will not infer a downward force as there is no downward movement, but the force of gravity on the materials may be mentioned.

17. Answers may vary. In most cases students will not infer an upward force, but the surfaces do exert a force that counters the force of gravity.

18. Yes, the brick was moved sideways. To move the brick required a noticeable amount of force.

Section 1: Activity 3

1. a. magnetic force (or magnetism)
   gravitational force (or gravity)

   b. The attraction of the nickel to the magnet is evidence of magnetic force.
   The fact that one of the nickels stayed in place is evidence of gravitational force.

2. a. gravitational force (or gravity)
   buoyant force (or buoyancy)

   b. The sinking of the ball-shaped piece of foil is evidence of gravitational force.
   The floating of the container-shaped piece of foil is evidence of buoyancy.

3. a. gravitational force (or gravity)
   frictional force (or friction)

   b. The sliding of the book down the breadboard is evidence of gravity.
   The book staying in place is evidence of friction.

Section 1: Follow-up Activities

Extra Help

Elastic Forces

Comments:

If a 100 g standardized mass is not available, students can use the 100 g test bag containing sand or other suitable material from Module 2.

Observations

Answers to both will vary. The second measurement will be greater than the previous one.

1. Gravitational force caused the rubber band to stretch.

2. The direction of the force is downward.

Magnetic Forces

Diagrams will vary, but should show one end of a thread tied to a paper clip and the other end taped to a table. A magnet should also be part of the diagram. Most likely the string will be stretched to the limit with the magnet just beyond the paper clip. The magnet should not be touching the paper clip.

3. The paper clip was moved by magnetic force.

4. The direction of the force is upward.
   In some cases, students may also move the paper clip sideways.

5. The paper clip was pulled downward by gravitational force.

Buoyant Forces

Observations

Answers will vary.

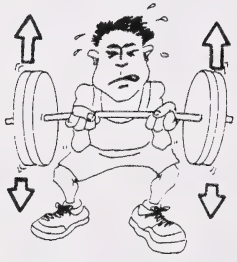
6. A buoyant force held up the pennies and lid.

7. The force acted in an upward direction.

8. The gravitational force became greater than the buoyant force.

Enrichment

1.



Answers should include arrows that indicate a greater upward force than downward force.

2. a. The forces are unbalanced.

   b. The toboggan is speeding up as it is pulled, or the arrows show that the forces are unbalanced.

   c. The force represented is a frictional force.

3. Answers will vary. Examples chosen should show two (or more) forces which are relevant to the example, and these forces should be named.

Note: The student should now complete the assignment for Section 1 in the Module 3 Assignment Booklet.

Section 2: How Can I Measure Forces?

By the end of this section students should be able to

- identify ways to detect and measure force
- describe how a force meter works
- recognize and use units of force (newtons)

Section 2: Activity 1

1. Answers will vary. Answers should show evidence of critical thought regarding the appropriateness of the material used. Example answers: an elastic band, a springy piece of metal.

2. Answers will vary. Answers should show evidence of critical thought regarding materials and techniques to be used. Example answer: A hook could be attached to a rubber band which is connected with whatever is to be moved. Other parts of the force meter may include a large dowel, or a cut broom handle, inside a cardboard tube.

3. Answers will vary. Answers should show evidence of creativity and critical thought regarding materials and techniques to be used. Example answer: The number of elastics used or the size of elastics used could be changed depending on the size of force.

Comments:

Students are to design and build their own force meter by using any suitable available material they wish. They are to follow the instructions under *Steps to Follow* in the Module Booklet but may refer to pages 148 and 149 of the textbook for ideas. If after testing their force meter on several objects, students found that their force meter did not work well, the learning facilitator should encourage students to make changes to improve their design. If the student is still having difficulty, some helpful suggestions may be given by the learning facilitator. Questions 4 and 5 are to be done after the student did the tasks mentioned under *Steps to Follow*.

4. Task a (most force) Task c Task b (least force)

5. a. In most cases the forces to move the book will all be greater than 100 grams.

   b. This will be indicated by the amount of deflection shown on the student's force meter.

Section 2: Activity 2

Note: Part A is optional. Students may do it if they wish. However, students must do Part B.

Part A: Calibrating a Force Meter (Optional)

Students may develop a calibrated force meter. Check the accuracy of the scale on their force meter. (The test bags constructed in Module 2 may be used as the 100 g, 300 g, etc. masses, if standardized mass sets are not available.) The force meter should be calibrated from 0 N to 10 N in 1 N divisions.

Part B: Using a Force Meter

Observations

Answers will vary. Depending on the size of book, it may take 5 N or 20 N to lift it. It takes about 10 N to 15 N to twist open an ordinary doorknob. Check for certain trends. For example, sliding an object will require less force than lifting an object. Also check that the arrows represent the "Direction of Force" accurately. Lifting requires an upward force, sliding requires a sideways force, turning a doorknob requires a twist to the left, opening a refrigerator door requires a pulling force.

1. Answers will vary. Answers should be consistent with the results shown in the student's observations chart.

2. a. Lift the object using the force meter. Observe the reading on the force meter.

   b. Pull the object using the force meter. Observe the reading on the force meter while you are pulling.

   c. Pull the object using the force meter on one side and holding the magnet fixed in one place.

   d. Measure the weight of an object; then measure the apparent weight if it is suspended in water. Subtract to find the difference between the two readings. This is the buoyant force.

Section 2: Follow-up Activities

Extra Help

Comments:

If a 1000 g standardized mass is not available, students can use a substitute such as a 1 kg bag of sugar, salt, flour, etc. Remember, a 1 kg bag of a substance will likely have a mass slightly more than 1 kg because the mass of the packaging material is included.

1. No, the mass will not be lifted by a 8 N force.

2. Approximately 10 N of force are required to lift a 1000 g mass.

3. The mass will not likely move.

4. Answers will vary, but should be significantly less than 10 N.

5. The spring scale is pulling against frictional force.

6. Answers will vary with the strength of the magnet.

7. Answers will vary. This will be a much stronger force than for question 6 (perhaps 10 to 20 times as great).

8. The spring scale is pulling against magnetic force (or magnetic attraction).

Enrichment

Comments:

In this activity students are to measure the strength of a buoyant force acting on objects in water. The instructions on how to do this are given in the Module Booklet. However, they may refer to the Force of Buoyancy on page 176 of *Science Directions 7* for additional information if needed.

Observations

Answers will vary depending on the objects chosen by the student. The buoyant force is calculated by subtracting the weight in water from the weight in air.

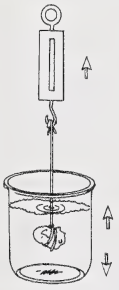
Check to see that the student has completed the chart for three objects of their choice in addition to the one object (stone) stated.

1. The force acting on the stone is gravitational force.

2. This force is acting downward.

3. The forces acting on the stone are gravitational force, buoyant force, and the upward force of the string.

4. The gravitational force acts downward. The buoyant force acts upward. The string also pulls upward.

5. 

6. The buoyant force would be 200 N. The upward force and the downward force are equal.

> Note: The student should now complete the assignment for Section 2 in the Module 3 Assignment Booklet.

Section 3: What Is the Difference Between Mass and Weight?

By the end of this section students should be able to

- describe changes in gravitational force that result from a change of position in space
- distinguish between mass and weight
- measure the mass of an object
- recognize and use units of mass (grams and kilograms)
- make graphs to identify patterns and trends

Section 3: Activity 1

> Note: Although there is a choice of doing either Part A or Part B, students are encouraged to do Part A. Only in circumstances where it is not possible to complete Part A are students to do Part B.

Part A

Comments:

Part A involves using actual equipment to measure mass and weight. Assist students to obtain a spring scale, balance scale, and a set of standard masses calibrated in grams to enable students to complete this part of the activity.

Observations

Answers will vary. In each case the mass of the object is to be in grams or kilograms and the weight in newtons. The number of newtons will be about 1/100 of the number of grams.

Check to see that the student measured the mass and weight of three objects of their own choice in addition to the three objects stated.

1. A balance scale should be used.
2. A spring scale should be used.
3. gram (g) or kilogram (kg)
4. newton (N)
5. Mass has to do with the amount of matter in an object. (It is measured in grams or kilograms.)
6. Weight has to do with the force of gravity on an object. (It is measured in newtons.)

Part B

Comments:

Some sample results of masses and weights of objects are given in the observation chart for Part B. Using these as guide lines, students are to complete the rest of the chart. Check to see that the observation chart is properly completed and that the correct units of measurement were used.

7.

Object Measured	Mass of Object	Weight of Object
banana	175 g	1.75 N
container of yogourt	500 g	5 N
bag of sugar	2 kg	20 N
box of salt	1 kg (or 1000 g)	10 N
carton of crackers	250 g	2.5 N
box of cereal	625 g	6.25 N

8. Check to see that questions 1 to 6 of Part A have been answered.

Section 3: Activity 2

Note: Students are to do either Part A or Part B.

Part A: Interplanetary Exploration of Weight and Mass

1. The gravitational force is different on each of the planets.

2. The amount of matter in the silver block does not change.

3. a. The weight of the silver was the greatest on Earth.

   b. The weight of the silver was the least on Mercury.

4. a. Earth has the greatest force of gravity of the four planets listed. This is shown by the silver weighing more on Earth than on any of the other three planets.

   b. Mercury has the smallest force of gravity. This is shown by the silver weighing less on Mercury than on any of the other three planets.

5. On Mercury you could jump the highest because of the smaller force of gravity.

6. Answers will vary. If there were no gravity, people would not likely be on the Earth. In fact, there probably would not be an Earth. All materials would be moving freely in space. Gravity is useful in keeping things in place and in providing friction so that things can be moved.

Part B: Interplanetary Investigation – Challenging Your Thinking About Weight and Mass

7. Answers will vary. Students might indicate any of the variables from the "Planetary Data" chart. (e.g., They might say mass of planet, distance from the sun, or length of day will most likely affect the mass on an object.)

8. Answers will vary. Look for evidence of critical thought.

9. Answers will vary. Students might indicate any of the variables from the "Planetary Data" chart.

   Reason for Hypothesis: Answers will vary. Look for evidence of critical thought.

10. No, the mass did not change.

11. c

12. c

13. c

14. Yes, the weight varied from 36 N to 100 N.

15. a

16. d

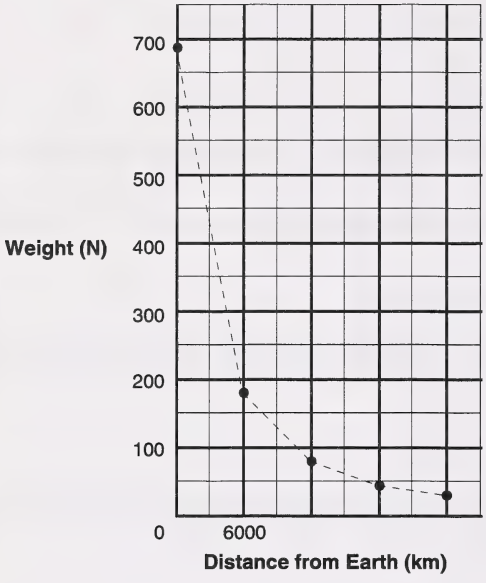
17. d

18. a. yes

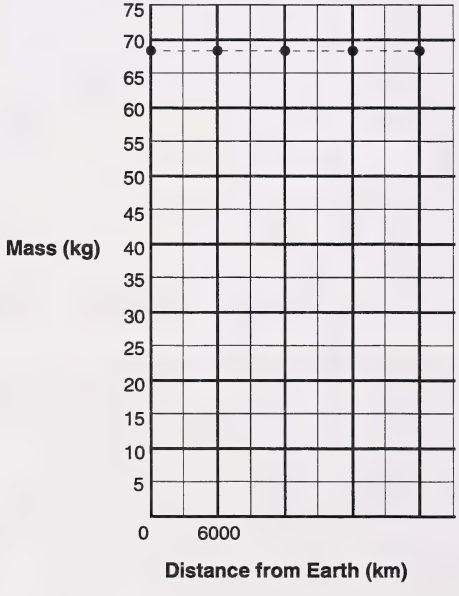
    b. The planets with the greatest mass exerted the greatest amount of force.

Section 3: Activity 3

1. a. **Graph One – Weight and Distance**



b. **Graph Two – Mass and Distance**



c. Graph One shows that the weight of an astronaut decreases as the distance from the Earth increases.

d. Graph Two shows that an astronaut's mass remains constant, no matter what the distance is from the Earth.

2. The Earth is much larger and exerts a stronger pull of gravity than does the Moon.

Section 3: Follow-up Activities

Extra Help

1. F Gravity acts between all objects.
2. F Mass is measured in kilograms; weight is measured in N.
3. T
4. T
5. F Weight is a measure of the force of gravity on an object.
6. T
7. F A scale calibrated in grams is used to measure mass.
8. F Weight decreases as you move away from the Earth's surface.
9. F Weight is a force.
10. Weight
11. decrease
12. greater
13. mass
14. grams (or kilograms)
15. graph

Note: Students may do either Part A or Part B,or they may do both Part A and Part B.

Comments:

Part A involves mathematical calculations. Some skill in working with ratios and proportions is required. Part B involves designing an experiment. Students are not required to do the experiment, just to develop a method.

Part A

Comments:

Students are to use the information given under Part A in the Student Module Booklet along with information from the chart "Distance from the Earth Versus Mass and Weight" in Activity 3 or the illustration on page 160 of the textbook, *Science Directions 7*, to answer the following questions.

1. a. The mass of the car is 1 000 000 grams.

   b. The weight of the car is about 10 000 newtons.

   c. The car would weigh about 2500 newtons 6000 km above the Earth's surface.

   From the chart in Activity 3, the weight of an astronaut at the surface of the Earth is 680 N, but at 6000 km from Earth it is 170 N. The weight of the car at the Earth's surface is
   10 000 N. When you solve for x in the following proportion you find its value to be 2500 N.

   $$\frac{680\ \text{N}}{170\ \text{N}} = \frac{10\,000\ \text{N}}{x\ \text{N}}$$

   d. The car would weigh about 630 newtons 18 000 km above the Earth's surface.

   This time the following proportion would apply.

   $$\frac{680\ \text{N}}{43\ \text{N}} = \frac{10\,000\ \text{N}}{x\ \text{N}}$$

   e. The weight of the car would be about 1700 newtons on the Moon.

   $\frac{1}{6}$ of 10 000 N is about 1700 N when rounded off.

   f. The mass of the car would be about 1000 kg on the Moon.

2. a. Answers will vary.

   b. This answer should be 1000 times the answer for a. (above).

   c. This answer should be about 10 times the answer for a. (above).

   d. This answer should be about one-quarter the answer in c. (above).

   The calculation here would be similar to that used in question 1. c. except the student's weight would be used in place of the car's weight. For example, a student having a 50 kg mass on the surface of Earth would have a weight of 500 N on the Earth's surface, but it would be 125 N 6000 km above the Earth's surface.

   e. This answer should be about one-quarter of the answer for d.

   The calculation here would be similar to that used in question 1. d. except the student's weight would be used instead of the car's weight.

   f. The student's weight will be about $\frac{1}{6}$ of what the weight is on Earth.

   g. The student's mass will be the same as it is on Earth.

Part B

3. Answers will vary. Students should indicate some way of measuring the force between two objects. The means of measuring does not need to be worked out in detail, but the intent should be clear that a procedure is to be established where a force measurement can be made. For example, some students may develop a method whereby they use force metres or spring scales calibrated in newtons to measure forces of attraction between objects. Other students may feel that the gravitational pull between objects on Earth is too small to be measured reliably, so they will choose a method involving space travel and describing a way of measuring the force of gravity between pairs of objects in the universe. Still others may choose to describe a method involving measuring the effect of the Moon upon objects on Earth, such as describing a method for measuring the Moon's effect upon producing ocean's tides.

4. Answers will vary. The key idea is that if there is such a force, then it should be measurable between any two objects studied. (The more massive the objects, the greater the forces should be.)

Note: The student should now complete the assignment for Section 3 in the Module 3 Assignment Booklet.

Section 4: What Makes Things Move or Stay in Place?

By the end of this section students should be able to

- predict the pathways of moving objects
- identify evidence and effects of friction
- describe methods of increasing or decreasing friction
- identify action-reaction pairs

Section 4: Activity 1

1. The muscles in the hand provide the upward force.

2. Gravity is the downward force.

3. Two forces of equal strength acting on an object in opposite directions are balanced forces.

4. The man's pulling force is causing the toboggan to move forward.

5. Friction tends to hold the toboggan back.

6. When a force acting on an object is greater than another force acting on the object in the opposite direction, the two forces are said to be unbalanced.

Section 4: Activity 2

1. a. Yes, the index card moved.

   b. It moved in the direction in which it was pushed (by flicking one's finger).

2. a. No, if done as directed, the penny will not move.

   b. It did not move. If there is a movement, it should be slight and it should be in the direction the card was moved.

3. yes

4. no

5. The inertia (the resistance to change) of the penny kept it from moving. An object at rest tends to remain at rest, unless a force is applied to it.

6. a. Yes, the index card moved.

   b. It moved in the direction in which it was pushed.

7. a. Yes, the penny moved.

   b. It moved downward into the glass.

8. yes

9. No, the force of gravity caused the penny to be moved downward into the glass.

Section 4: Activity 3

1. a. The papers fell off the back of the wagon because their inertia at rest kept them in their original place as the wagon moved forward.

   b. Tyler should start the wagon moving very slowly and gently, and/or he could hold onto the papers as the wagon starts to move.

2. a. The papers fell off the front of the wagon because their inertia in motion kept them moving when the wagon stopped suddenly.

   b. Tyler should avoid situations where he must stop suddenly, and he should bring the wagon slowly and gently to a halt.

3. If a car were to stop suddenly and you did not have your seat belt on, the inertia of your body in motion would make you continue to move forward, perhaps throwing you out of your seat and into the windshield.

4. Objects at rest do not move unless a force acts upon them.

5. Objects already moving continue to move at the same speed and in the same direction, unless an unbalanced force acts on them.

Section 4: Activity 4

Observations

Answers will vary.

Questions to Answer

1. Depending on the surface finish, it may be the wood or the linoleum.

2. The oiled linoleum surface would have the least force.

3. a. Answers may vary. It could be either the wood or the linoleum.

   b. The force to move the bricks was greatest for this surface.

4. The effect was an increase of the force required to move the bricks.

5. The force required to move the bricks was decreased.

6. Answers will vary, but most likely the force required should increase.

7. Smooth the surface; or lubricate the surface.

8. You could roughen the surface.

9. The extra weight of the engine over the drive wheels causes the car to get more traction.

Section 4: Activity 5

1. The surfaces roll over each other instead of sliding.

2. a. Answers will vary. Students may circle the wheel hubs, the points of contact along the chain, or the crankshaft (pedal) axle.

   b. Answers will vary. Points chosen should be places where one part makes contact with another part that is moving.

3. Answers will vary. Example answers:

   - The brakes on a car or on a bicycle become warm or hot after a long, downhill ride.
   - An early method of starting a fire was to rub a piece of wood rapidly over and over again against another piece of wood.

4. Parts of the sole will be worn off.

5. The bicycle or car tire will show signs of wear.

Section 4: Activity 6

Note: Students are to do either Part A or Part B.

Part A

1. Prediction: The car/truck will move across the cardboard.

2. When the motor is turned on, the cardboard is pushed back by the car/truck at the same time as the car/truck starts to move forward.

3. They push back on the cardboard.

4. A car/truck pushes against the road. The action of the tire against the road causes the reaction of the car/truck moving forward.

Part B

5. The action which takes place first is the air rushing out of the balloon.

6. The reaction is the movement of the balloon.

7. first action: The air moves out of the balloon to the left.

   reaction: The balloon moves to the right.

8. The rocket or the balloon can only move forward if there is some material that is moved in the opposite direction.

Section 4: Follow-up Activities

Extra Help

Comments:

In place of a table tennis ball and golf ball, other objects of similar size but different masses can be used. For example, a glass marble and steel ball bearing, or a regular tennis ball and a baseball will work well.

1. Answers will vary.
2. The table tennis ball stops and bounces off in the other direction. The golf ball is only moved slowly in the other direction.
3. Answers will vary.
4. The table tennis ball starts to move rapidly in the other direction (more rapidly than the golf ball was moving when it hit it). The golf ball slows down but does not stop.
5. Objects that have more mass have more inertia. Objects tend to keep moving or stay where they are unless acted on by a force.
6. The truck will require more braking force as it has more mass and greater inertia.

Enrichment

Students may do either Part A or Part B, or, they may do both Part A and Part B.

Part A: Effects of Friction

1. a. As you pedal along you create a slight breeze against your skin, hair, and clothes. Your skin begins to feel cool as a result.
   b. You feel cooler as the air rushes past.
2. a. It is much more difficult. One cannot move nearly as fast.
   b. The surface of your body moves against the water.
   c. It is harder to run in water because the frictional forces are greater; or, water is a more dense fluid than air.
3. a. The movement of the rapidly moving shuttle through the air causes the temperature on the outer surface of the shuttle to rise because of the friction between the air and the shuttle.
   b. Frictional force slows the shuttle.

Part B: Satellite Motion

Comments:

Part B is based on instructions given in the Student Module Booklet and on the information given on pages 186 and 187 of *Science Directions 7*.

Caution

Everyone should be at least 3 m from the model when it is being demonstrated.

1. The stopper represents the satellite.
2. The piece of tubing – or perhaps your hand represents the Earth.
3. a. The tension of the string pulled the stopper closer to the tubing.

   b. Gravitational force pulls a satellite closer to the Earth.
4. You need to increase the speed.
5. The radius of the object will increase. (It will orbit the Earth at a greater distance from the Earth.)
6. a. Gravitational force keeps the Moon from moving away from the Earth.

   b. It would come closer to the Earth. (Its orbit would be closer to the Earth.)
7. The motion of the Earth and the gravitational force of the Sun keep the Earth in its orbit.

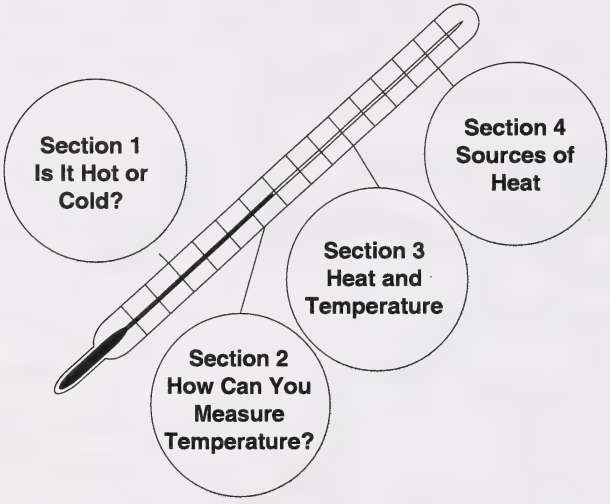
Note:
1. The student should now complete the assignment for Section 4 in the Module 3 Assignment Booklet.
2. Check to see that all assignments have been completed and that all written work is done neatly in blue or black ink. Diagrams may be left in pencil.
3. The completed Assignment Booklet should now be submitted to the Alberta Distance Learning Centre for correction. The student can proceed with the next module while waiting for the return of the Assignment Booklet.

Module 4 - Temperature and Heat: Overview

The major emphasis of this module is on the nature of science. However, opportunities are also present for students to apply their science knowledge to the solving of practical problems and to better understand the relationship among science, technology, and society. Students continue to discover how scientists work – by observing, asking questions, performing experiments, and providing explanations for their observations.

Module 4 examines the effects of heat and temperature changes with particular attention to methods of measuring these. The need for accuracy and the need for specialized thermometers are part of this module.

In this module, students study the effects of heating and cooling water, and learn to distinguish between heat and temperature. Students determine how the energy content of various foods and fuels can be measured, and study the uses of various sources of heat which include chemical, mechanical, electrical, geothermal, and solar energy.



Caution

A number of activities in this module involve the use of hot plates or flames. These activities should all be done with the advice and supervision of the learning facilitator.

Evaluation

The student's successful completion of all assignments will depend on practice obtained while doing the various activities. Many choices of activities have been provided so that students have some control over their own learning.

The following distribution of marks will determine the student's grading for this module.

Section 1 Assignment	**12 Marks**
Section 2 Assignment	**32 Marks**
Section 3 Assignment	**26 Marks**
Section 4 Assignment	**30 Marks**
TOTAL	**100 Marks**

Each module in Science 7 is worth 10% of the student's course mark. The final test, based on the learnings from all six modules, is worth 40% of the total final grading.

Materials Needed for Module 4

Comments:

For a complete overview of the materials needed for Module 4, and how the topics are developed, it may be helpful to preview the contents of Module 4. In some cases, if the materials suggested are not readily available, the learning facilitator may be able to substitute suitable materials for the student or make arrangements to use laboratory facilities at a local school so that the activities can be completed successfully. In other cases, the student may need to choose a pathway that does not require the materials, or contact the Alberta Distance Learning Centre regarding the purchase of a laboratory kit containing some of the items needed if this has not been previously done.

The materials needed for Module 4 and the activities in which they are to be used are as follows:

Section 1: Activity 1

- 14 index cards

Section 1: Activity 2

- a bowl of hot tap water
- a bowl of cold tap water
- a bowl of lukewarm tap water

Section 1: Activity 3

- uncalibrated thermometer
- four heat-resistant glasses, beakers, or cups
- water
- ice
- kettle to boil water in
- masking tape
- marking pencil

Section 1: Activity 4

Part B

- uncalibrated thermometer
- masking tape
- marker
- water
- ice cubes
- beaker or cooking pot
- beaker or drinking glass
- oven mitt
- ruler
- hot plate or stove

Section 1: Extra Help

- laboratory thermometer (with scale from below 0°C to above 100°C)

Section 2: Activity 3

- round balloon
- string
- ruler
- felt marker

Section 2: Activity 4

Part A

- bimetallic strip, with a handle
- heat source with a flame

Section 2: Activity 5

Part A

- water
- cooking oil
- glycerine
- hot plate (or stove)
- three large test tubes
- three one-holed stoppers, each with a long piece of clear plastic tubing inserted
- 500 mL beaker
- stirring rod
- support stand and clamps (optional)
- masking tape

Section 2: Activity 6

Part A

If students choose to do Part A they will need three different thermometers (at least one solid and one liquid thermometer). Aside from liquid and spring-type weather thermometers, choices might include specialized thermometers such as a clinical thermometer, liquid crystal thermometer, oven thermometer, or a thermostat.

Section 2: Enrichment

- round-bottomed flask
- 30 cm of transparent rigid plastic tube
- one-holed stopper
- large beaker or container
- coloured water (at room temperature)
- support stand
- clamp
- masking tape

Section 3: Activity 1

- water
- thermometer, with a range to 100°C
- graduated cylinder or measuring cup
- hot plate or stove
- beaker
- support stand (optional)
- two clamps (optional)
- timer

Section 3: Activity 2

- hot plate or stove
- beaker, heat resistant cup, or small pan
- thermometer, with a range to 100°C
- graduated cylinder or measuring cup
- water
- cooking oil
- glycerine (glycerol) or anti-freeze
- support stand (optional)
- two clamps (optional)
- timer

Section 3: Activity 5

- two cups or beakers
- uncalibrated thermometer
- 100 mL graduated cylinder or measuring cup
- hot water from tap
- stirring rod, stir stick, or spoon
- masking tape
- cold water

Section 3: Activity 6

- two cups or beakers
- uncalibrated thermometer
- 100 mL graduated cylinder or measuring cup
- hot water from tap
- stirring rod, stir stick, or spoon
- masking tape
- cold water

Section 3: Activity 7

- two cups or beakers
- uncalibrated thermometer
- 100 mL graduated cylinder or measuring cup
- cold water
- hot water from tap
- cooking oil
- masking tape
- stirring rod, stir stick, or spoon

Section 3: Enrichment

Part A

- thermometer
- beaker or cup
- water
- freezer
- timer

Section 4: Activity 1

Part A

- a shelled peanut
- a shelled walnut
- pin embedded in a cork or eraser
- two empty pop cans
- graduated cylinder or measuring cup
- oven mitt
- thermometer
- matches
- safety glasses
- water
- aluminum foil

Section 4: Activity 2

Friction:

- brick (or piece of concrete)
- large nail

Bending:

- paper clip

Pounding:

- wooden block
- hammer

Section 4: Enrichment

- birthday candle
- large candle
- two empty pop cans
- thermometer
- oven mitt
- timer
- graduated cylinder or measuring cup
- water

Section 1: Is It Hot or Cold?

By the end of this section students should be able to

- infer temperatures based on physical properties
- compare temperatures of materials without using numbers
- make a temperature scale
- describe the Celsius temperature scale

Section 1: Activity 1

Comments:

- The aim of this activity is to see how much the student already knows about temperature. The temperatures in a number of different situations are to be estimated.
- Check to see that the student has followed the instructions given and has completed the charts for questions 1 and 2. (If the student couldn't find the actual temperatures for the items by library research, then you can give these temperatures to the student. The actual temperature of each item is shown in brackets in the answers given in the chart for question 2.)

1. Answers will vary. These estimates do not need to be marked; the purpose of the exercise is to start students thinking in preparation for question 2.

2. To assist the marker, the actual temperature of each item is shown in brackets. This is not a required part of the student answer.

Actual Order from Hottest to Coldest

hottest

- interior of sun (15 000 000°C)
- surface of sun (6000°C)
- oven temperature (165°C)
- boiling water (100°C)
- hot tea (80°C)
- hottest air temperature (58°C)
- bath or shower (40°C)
- body temperature (37°C)
- room temperature (20°C)
- air in refrigerator (1 to 3°C)
- temperature at which water freezes (0°C)
- ice cream (– 5° to – 10°C)
- coldest air temperature (– 88°C)
- lowest temperature possible (– 273°C)

coldest

Section 1: Activity 2

1. That hand felt cool (or the water felt cool).

2. That hand felt warm (or the water felt warm).

3. a. No, touch is not a reliable indicator of temperature.

   b. Answers will vary. The following two answers are example answers:

   - The way the temperature feels depends on the situation.
   - What feels warm in one situation may feel cold in another situation.

Section 1: Activity 3

1. a. Glass 4 contained the hottest water.

   b. The liquid in the thermometer was highest when the thermometer was placed in this glass.

2. a. Glass 1 contained the coldest water.

   b. The liquid in the thermometer was lowest when the thermometer was placed in this glass.

3. hottest glass 4
   glass 3
   glass 2
   coldest glass 1

4. Answers will vary. The key idea that should be brought out in the student answer is the idea of objectivity. The following two answers are examples:
   - The temperature does not depend on how you feel.
   - You can measure exactly how warm or cold the water is.

Section 1: Activity 4

Note: Students are to do either Part A or Part B.

Part A: Calibrating Your Thermometer by Your Own Method

1. Answers will vary. One approach that might be used is as follows:

   - Place the thermometer in a container of ice water.
   - Put some tape on the thermometer and mark the temperature of the ice water as 0°C (for the level when the thermometer is placed in the ice water).
   - Place the thermometer in boiling water.
   - Mark the temperature as 100°C.
   - Mark the halfway point as 50°C.
   - Mark halfway between 0°C and 50°C as 25°C.
   - Continue to add marks on the thermometer for every 5°C by dividing each 25 degree space into five spaces.

   Another more simple approach which students might use is as follows:

   - Obtain a calibrated thermometer to use as a comparison.
   - Place the calibrated thermometer and the uncalibrated thermometer in cold water.
   - Read the temperature on the calibrated thermometer; then make a mark on the uncalibrated thermometer so it reads the same.
   - Place the thermometers in somewhat warmer water.
   - Read the new temperature on the calibrated thermometer; then make a new mark on the uncalibrated thermometer to show this new temperature.
   - Continue steps 4 and 5 until as many markings as desired are shown.

2. Check the student's method and suggest how improvements can be made, if any are needed. The example answers given for question 1 can serve as a guide.

3. Check to see that the student has the necessary materials.

4. Check to see that the student has calibrated a thermometer. If this is done well, then a reasonably accurate answer should be given to question 5.

5. Answers will vary. A temperature range of 18°C to 23°C is normal.

Part B: Calibrating Your Thermometer by Following Directions

Comments:

If the student chooses Part B, check to see how well the instructions to calibrate the thermometer given in steps 1 to 8 in the Module Booklet were followed.

6. The answers will vary. A temperature range of 18°C to 23°C is normal.

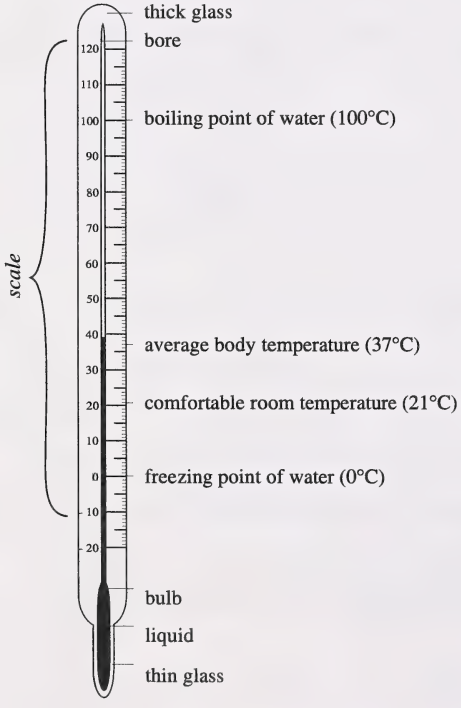
Section 1: Follow-up Activities

Extra Help

Comments:

For this Extra Help activity, the student is to examine a laboratory thermometer with a scale from below 0°C to above 100°C. Remind students to handle laboratory thermometers carefully as they break easily.

1.



2. There is no change in temperature.

3. The temperature rises.

4. Answers will vary. The following two answers are examples:
   - The bulb is the part that is sensitive to temperature.
   - The bulb is the part with most of the liquid.

5. a. The bulb (bottom of the thermometer) has the thinnest glass.

   b. Answers will vary. The actual reason is to allow the thermometer liquid to adjust rapidly to the temperature of the material in which the thermometer is placed.

6. There are 100 Celsius degrees difference between the boiling point and the freezing point of water.

7. Answers will vary. The actual reason is two-fold. Firstly, there is a problem in that water would not give a temperature reading below 0°C or above 100°C. Secondly, if the temperature were reduced to below freezing, the bulb would break.

8. The thermometer is not constructed for a temperature this high; it would break.

Enrichment

1. Where a range of answers is shown, any answer in this range is acceptable.

	Temperature in Degrees Celsius	Temperature in Degrees Fahrenheit
temperature at which water freezes	0°C	32°F
temperature at which ice melts	0°C	32°F
temperature at which water boils	100°C	212°F
temperature of a hot summer day	23°C to 33°C	75°F to 90°F
temperature of a cold winter day	– 35°C to – 20°C	– 30°F to – 5°F
comfortable room temperature	21°C	72°F
average normal body temperature	37°C	98.6°F

   a. Daniel Gabriel Fahrenheit

   b. low point: coldest temperature of ice-salt water mixture (0°F)

      high point: human body temperature (96°F)

Originally Daniel Fahrenheit took the temperature of an ice and salt mixture as the zero of his scale and the value of 96° for normal body temperature. Later experiments showed normal body temperature to be higher than this and normal body temperature was adjusted to 98.6°F on the final scale.

On the Fahrenheit scale 32°F was the freezing point of water and 212°F was the boiling point of water. The interval between these two points was then divided into 180 parts.

2. a. The freezing point of water is 0°C or **32** °F.

   b. The boiling point of water is 100°C or **212** °F.

   c. Average normal body temperature is 37°C or **98.6** °F.

3. a. Comfortable room temperature is 70°F or **21** °C.

   b. A hot summer day is 86°F or **29** °C.

   c. A very cold winter day is – 40°F or – **40** °C.

Note: The student should now complete the assignment for Section 1 in the Module 4 Assignment Booklet.

Section 2: How Can You Measure Temperature?

By the end of this section students should be able to

- classify matter as a solid, a liquid, or a gas
- predict changes in materials due to heating and cooling
- compare the amount of thermal expansion for different materials
- describe how liquid and air thermometers work
- identify several specialized thermometers and describe how they work

Section 2: Activity 1

1. • gas
   • liquid
   • solid

2. Liquids and gases can flow.

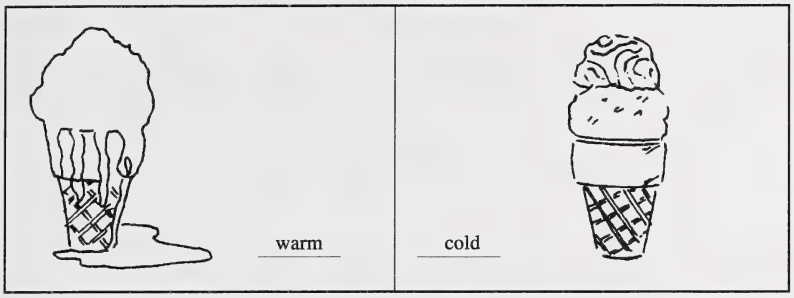
3. Solids and liquids cannot be compressed.

4. The volume of a material is the amount of space it occupies.

5. Compressed means to be squeezed to fit (in a limited space).

Section 2: Activity 2

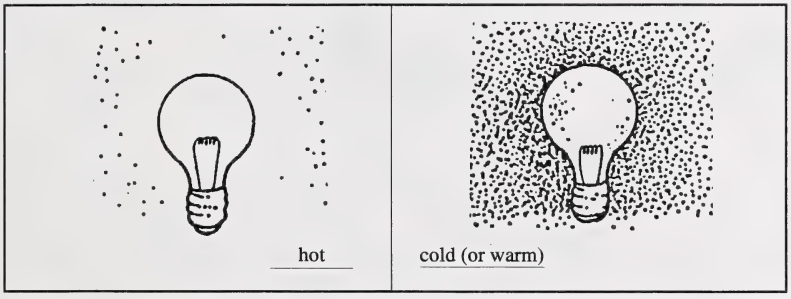
1. Ice Cream Cones



Evidence: The ice cream is melting.

Evidence: The ice cream has not melted.

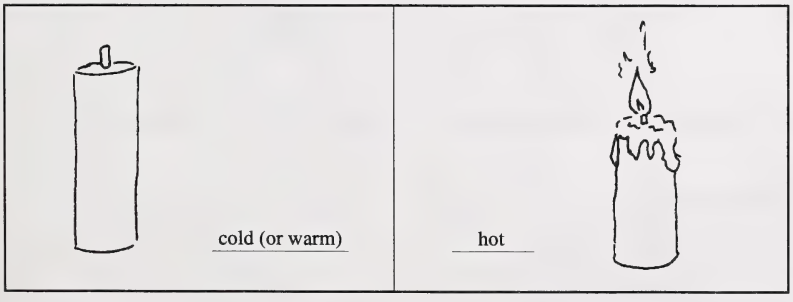
2. Light Bulbs



Evidence: The light bulb is lit up.

Evidence: The light bulb is not lit. It is at room temperature.

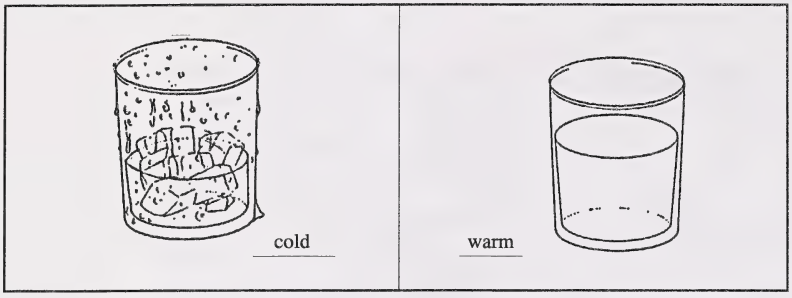
3. Candles



Evidence: The candle is not lit. None of the wax has melted.

Evidence: The candle is lit. Some of the wax near the flame has melted.

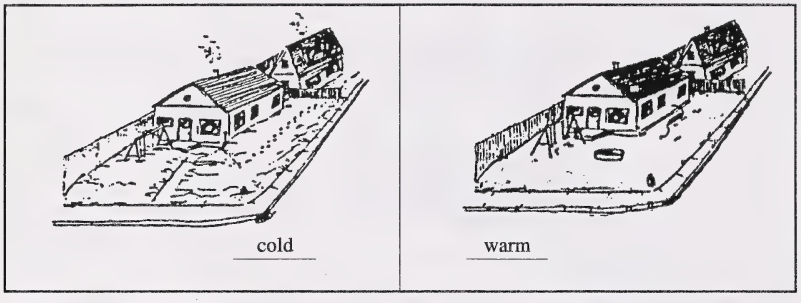
4. Drinking Glasses



Evidence: The water is cooled by ice. Water droplets on the outside of the glass show that the glass is cold.

Evidence: The water has no ice in it. There are no droplets of water on the outside of the glass.

5. Weather



Evidence: The yard is covered with snow. There is smoke rising from the chimneys.

Evidence: There is no snow, and no smoke is rising from the chimneys. A child's swimming pool is shown in the yard.

Section 2: Activity 3

Observations

Answers will vary. The circumference of the balloon at room temperature should fall between the other two measurements.

1. The circumference is less when the balloon is cooled.
2. The circumference becomes greater when the balloon is heated.
3. The warmer the temperature, the larger the balloon becomes; the lower the temperature, the smaller the balloon becomes.
4. If you measured the size of the balloon, this would provide a way of measuring temperature.

Section 2: Activity 4

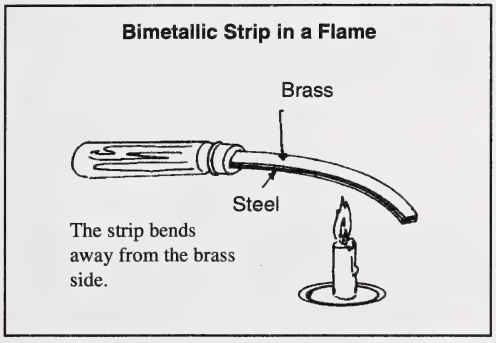
Note: Students are to do either Part A or Part B.

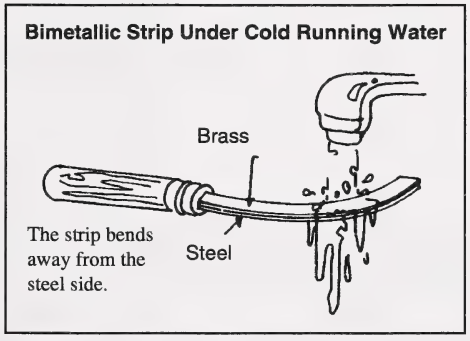
Comments:

Students should be encouraged to do Part A if a bimetallic strip with a handle is available. A candle can be used as the heat source. Since an open flame is being used, see that proper safety precautions are being followed.

Part A

Observations

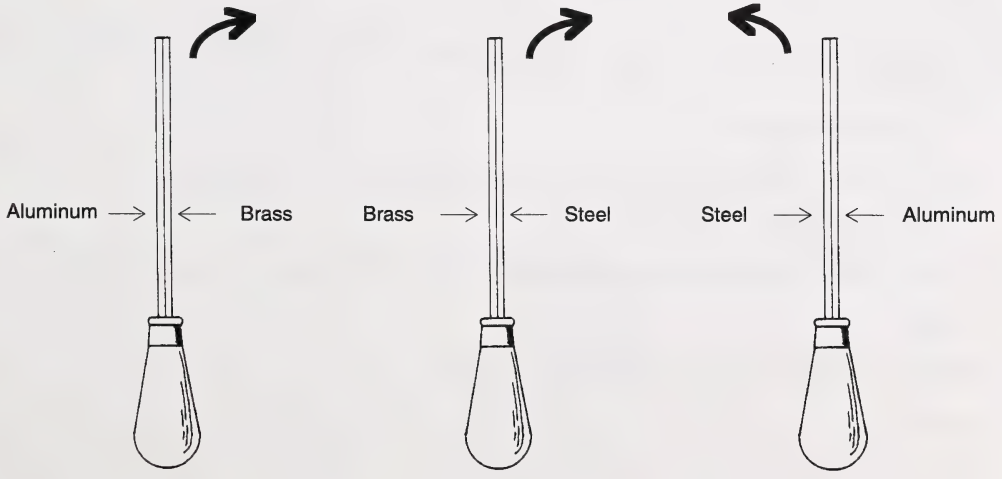




1. The handle of the bimetallic strip should be held firmly or attached securely to something. The other end of the bimetallic strip should be above the scale centered over "Room Temperature." As the bimetallic strip is heated it should bend towards "Warm," and as the bimetallic strip is cooled below room temperature it should bend towards "Cool."

   The brass side should be on the left; the steel side should be on the right.

2. a.



b. The strip made of aluminum and steel will bend the most.

c. The greater the difference in expansion of the materials, the greater the bending.

3. When heated, the bimetallic strip coils more tightly, which turns the toothed wheel and the pointer.

Part B

Comments:

If a student chooses Part B, then explain the diagrams given under the Observations for Part A. After the student understands the observations, questions 1 to 3 of Part A are to be answered. Check that these questions have been answered.

Section 2: Activity 5

Note: Students are to do either Part A or Part B.

Part A

Caution

This activity is to be done under the supervision of the learning facilitator.

Comments:

- Students will need help in setting up the materials to do this experiment. If a support stand with clamps is not available, some other suitable method to keep the test tubes upright will need to be found. Rigid plastic tubing instead of glass tubing should be inserted through the rubber stoppers.

- If arrangements cannot be made for a student to use a school laboratory in order to complete Part A, then Part B should be done. However, you as the learning facilitator may be able to come up with suitable alternatives for Part A. For example, you may want to try using small pop bottles instead of test tubes, plastic straws instead of tubing, putty instead of a rubber stopper and a pot or double boiler instead of a beaker.

Observations

Answers will vary. Students should indicate that the level of liquids in each of the tubes went up as it was heated. Students should also provide a measurement of how much each of the liquids went up.

1. a. Yes, they expand when heated.

   b. By experimentation, students will have observed that the level of a liquid in a container rises when heated.

2. a. No, some expand more than others.

   b. By experimentation, students will have observed a different rise in levels for different liquids that were heated.

3. a. alcohol

   b. Alcohol can be cooled to a very low temperature before it freezes.

4. a. mercury

   b. It is still a liquid at 100°C. (It does not boil until it reaches 357°C.)

Part B

Comments:

Since students were unable to do the experiment for Part A, they will come to you for the observations that should have been obtained. Mention the following observations:

- The level of the liquids went up in all of the test tubes as they were heated.
- The levels for the three liquids were all different after being heated an equal amount of time.

Check to see that questions 1 to 4 in Part A have been answered.

Section 2: Activity 6

Note: Students are to do either Part A or Part B.

Part A: Comparing Thermometers

Comments:

- You may need to help the student obtain three different thermometers needed for Part A. The marking of questions 1 and 2 must agree with the selection of thermometers made. Aside from both liquid and spring-type weather thermometers, choices might include specialized thermometers. For example, Thermometer 1 might be a clinical thermometer, Thermometer 2 might be a liquid crystal thermometer, and Thermometer 3 might be an oven thermometer.
- Another common type of thermometer is the thermostat. It is used to measure the temperature of an appliance or a room. Students find it interesting to see how a room thermostat works. With your guidance, the cover of a thermostat can be removed to show how a bimetallic strip is used to turn a furnace on or off at a pre-set temperature.

1. The answers in the chart are for a clinical thermometer, a liquid crystal thermometer, and an oven thermometer respectively.

Characteristic of Thermometer	Thermometer 1	Thermometer 2	Thermometer 3
length (cm)	Answers will vary according to thermometers used. Three answers are provided as examples		
width (cm)			
lowest temperature	35°	35°	0°
type of degrees	Celsius	Celsius	Celsius
substance that expands (solid, liquid, or gas)	liquid	liquid crystal	solid (bimetallic strip)
thermometer's use	for measuring body temperature	for measuring body temperature	for measuring inside temperature of an oven
advantages	It is very accurate in a limited temperature range.	It is easy to use. It is unlikely to be broken.	Answers will vary. (e.g.) It can measure hot temperatures. It is not easily broken.
disadvantages	It measures only a small range of temperature. It has to be sterilized after use.	It is not as accurate as the liquid thermometer.	Answers will vary. There is limited use where precise measurement is needed due to a wide temperature range.

2. The marking of these questions must agree with the type of thermometers used.

   a. Thermometer 1: A liquid is used because it helps make the thermometer very precise. The liquid in the clinical thermometer expands uniformly between 35°C and 42°C.

   b. Thermometer 2: Liquid crystals are used because they are very easy to read from a colour chart.

   c. Thermometer 3: Solid metals are used because they remain solid at high temperatures.

Part B: Special Thermometers for Special Purposes

3. Human body temperature falls within this range.

4. The constriction keeps the liquid at its highest level until it is shaken down.

5. Answers will vary. The following three answers are examples:

   - The thermometer can be reused without being sterilized.
   - It is easy to read.
   - It is not easily broken.

6. A liquid crystal thermometer is not as accurate.

7. Answers will vary. Refrigerators, ovens, electric irons, toasters, hair dryers, and electric frying pans are some examples of appliances controlled by thermostats.

8. When a pre-set temperature is reached and no further heating is required, the appliance is switched off.

9. Answers will vary. The following four answers are examples:

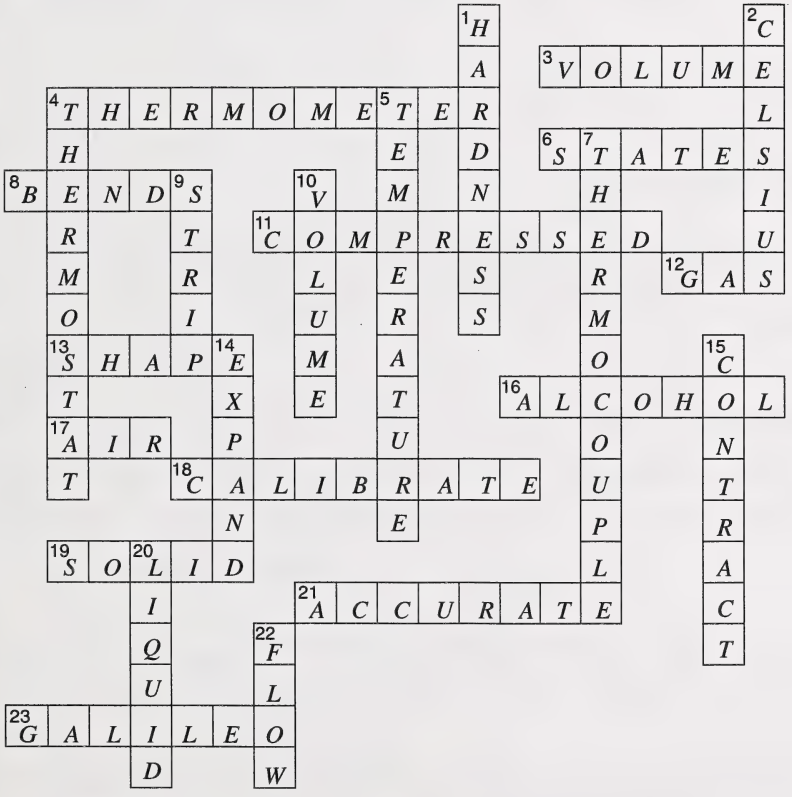
   - in the heating of a hot water tank
   - in an engine
   - in a kiln
   - in a place that is hard to get at, such as a smokestack

10. It is a device that measures temperature by analyzing the light given off by an object as it is heated.

11. It can be used for measuring very high temperatures e.g., temperatures that would melt ordinary metals.

Section 2: Follow-up Activities

Extra Help



Enrichment

1. The water moved downward.

2. The air expanded into some of the space that had been taken up by the water.

3. The water moved upward.

4. The air contracted. The water moved up to take up space that had been taken up by the air.

5. Answers will vary. Following is a sample of a satisfactory response:
   Tape a piece of light-coloured cardboard to the glass tube. Using a calibrated thermometer, measure the actual temperature of the air around the apparatus. Place a small line and a number to show the temperature on the cardboard. Make additional markings by the tube to show the level of the water at different temperatures, taking care to let the apparatus adjust to each new temperature.

6. Answers will vary. The following two answers are examples:

   - It does not require the use of a special liquid.
   - It is fairly easy to read.

7. Answers will vary. The following three answers are examples:

   - It is very large and could be cumbersome to use.
   - It could easily be broken or upset.
   - It requires the use of some fairly expensive apparatus.

Note: The student should now complete the assignment for Section 2 in the Module 4 Assignment Booklet.

Section 3: Heat and Temperature

By the end of this section students should be able to

- estimate the final temperature of mixtures of liquids
- distinguish between heat and temperature
- describe temperature and heat in terms of particle motion

Section 3: Activity 1

Caution

This activity is to be done under the supervision of the learning facilitator.

Observations

Answers will vary. After the first minute of heating, the temperature rise in each case will likely be fairly constant. The temperature of the 100 mL of water should rise more quickly than the temperature of the 200 mL of water.

Graph One: Temperature Change and Heating Time for Water

Answers will vary. All figures shown on the graph should agree with those in the student's observation chart. The slope of the line for 100 mL of water should be more steep showing that it increases in temperature more quickly than the 200 mL of water.

1. a. Yes, it should be about the same for both.

   b. Each was heated for the same length of time using the same heat source.

2. The 100 mL of water had the higher temperature.

3. Answers will vary. Students should in some form indicate the idea that the more water used, the slower it will heat.

4. a. No. (They should show that they are different.)

   b. This is a fairly difficult question that requires abstract thought. Some students will likely need assistance with this question. If heat and temperature were the same, the temperature would go up the same amount whenever the same amount of heat is added.

5. c

6. The more water you have, the more heat it takes to cause a temperature rise.

Section 3: Activity 2

Caution

This activity is to be done under the supervision of the learning facilitator.

Observations

Answers will vary. Results should indicate a more rapid rate of heating for cooking oil and glycerine than for water.

Graph Two: Temperature Change and Heating Time for Three Different Liquids

Answers will vary. All figures shown on the graph should agree with those in the student's observation chart.

1. a. Yes, it should be the same for both.

   b. Each of them was heated for the same length of time using the same heat source.

2. The answer can be either glycerine or cooking oil. Answers may vary slightly with the specific brand of material used. Answers given should agree with the student's experimental results recorded in the observations chart.

3. The water would show the smallest increase.

4. a. No, they should show that they are different.

   b. If they were the same, the temperature would have gone up the same amount for each of the liquids.

5. b

6. • The water would take longer to heat to this temperature. **or**
   • The water would require more heat to bring it to 50°C.

Section 3: Activity 3

Note: Part A is optional, but students must do Part B.

Part A: Designing an Experiment (Optional)

Materials You Need

Answers will vary. Check to see that the student's design is a suitable way to test Lavoisier's hypothesis. The following answers are provided as examples:

- beaker
- hot plate
- water
- thermometer
- several ice cubes
- balance scale

Steps to Follow

Step 1: Fill the beaker half full of water.
Step 2: Add two or three ice cubes.
Step 3: Determine the mass of the beaker and its contents.
Step 4: Heat the beaker of water to about room temperature.
Step 5: Determine the mass of the beaker and its contents.
Step 6: Compare the mass after heating with the mass before heating.

Part B: Interpreting an Experiment

1. It should lose mass because when it freezes, it should lose caloric fluid.

2. No, it did not.

3. • The mass did not change when some water was frozen. **or**
   • The ice had the same mass as the water.

Section 3: Activity 4

1. The particle theory states that all matter is made up of tiny particles that are always moving.

2. It is more than a possible explanation of how matter behaves. So far all the experiments done by scientists support the ideas that all substances are made up of moving particles.

3. The total energy in a sample of matter is accounted for by

   - temperature (the average speed of particles)
   - type of matter (the type of particles)
   - amount of matter (the number of particles)

4. The temperature is the same because the average energy of the particles is the same in both samples.

5. The temperature is higher in the cup of water at 80°C because the average energy of the particles is greater.

6. The total energy content is greater in the kettle with water because there is a greater number of particles present.

7. Heat transfers from the warmer water to the cooler water.

Section 3: Activity 5

Comments:

If an uncalibrated thermometer is not available for the experiment in this activity, then an ordinary laboratory thermometer may be used.

1. b
2. It would be about halfway between the two temperatures. The temperature may be slightly less than halfway because some heat is lost to the container and to the surrounding air.
3. The particles of hot water are slowed down and the temperature of that water drops. The particles of the cold water speed up and the temperature of that water rises.
4. a. The temperature would be 40°C, assuming no heat losses to the environment had occurred.

   b. The temperature drop for the hot water will be the same as the temperature rise of the cold water.

Section 3: Activity 6

Comments:

If an uncalibrated thermometer is not available for the experiment in this activity, then an ordinary laboratory thermometer may be used.

1. a
2. The final temperature was closer to the hot water temperature.
3. a. The final temperature would be about 50°C.

   b. When unequal amounts of water are mixed, the final temperature will be nearer the temperature of the greater amount of water.

Section 3: Activity 7

Comments:

If an uncalibrated thermometer is not available for the experiment in this activity, then an ordinary laboratory thermometer may be used.

1. It was closer to the temperature of the water.
2. a. 50°C

   b. The temperature of the oil and water mixture in Activity 7 was closer to the temperature of the water.

Section 3: Follow-up Activities

Extra Help

1. Heat will flow from your back to the water.
2. Heat will flow from the water at 90°C to the water at 25°C.
3. Heat will flow from the spoon at 25°C to the water at 5°C.
4. Matter is made up of small **particles**.

5. Heat moves from **hotter** substances to **colder** substances.
6. Particles of matter are always **moving**.
7. 100 mL of water has **more** particles than 25 mL of water.
8. Water at 35°C has **faster** particles than water at 25°C.
9. 100 mL of oil at 35°C has **more** total energy than 50 mL of oil at 35°C.
10. 35 mL of water at 15°C has the same **temperature** as 200 mL of cooking oil at 15°C.
11. Because there are more particles of water in 200 mL, it requires more heat to change the temperature than for 100 mL.
12. (Optional) Less heat is required to change the temperature of the oil than for the water.

Enrichment

Note: Students may do either Part A or Part B, or they may do both Part A and Part B.

Part A: Temperature Change During Melting

Observations

The basic form of the chart should be as shown at the right. The actual temperatures recorded will vary, but they should reflect a rapid increase to 0°C followed by a long period of constant temperature. The temperature begins to increase again after all the ice is melted.

Time (in minutes)	Temperature (°C)
0	
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	

1. Melting takes place.
2. The heat comes from the surrounding air.
3. The temperature stays the same while melting.
4. Answers will vary. This is a good temperature to use because it involves one of the most common materials we use.

Part B: Predicting Based on Theory

5. The water at 30°C is the higher temperature.
6. a. The cup at 30°C contains the most energy.

   b. The amount of water is the same so there are the same number of particles, but the particles at 30°C have more energy.
7. a. Heat would move from the hot water to the cooler water.

   b. Answers will vary. The following answer is an example:
   The particles in the hot water are moving faster and have more energy.
8. a. iii.

   b. There were equal volumes of water. The temperature gained by the cold water was the same as the temperature lost by the warm water.
9. They are both at the same temperature.
10. a. The cup with 300 mL of water contains the most energy.

    b. There are more particles in 300 mL of water.
11. a. There would not be a movement of heat.

    b. The water is at the same temperature so there would be no movement of heat.
12. The final temperature would be 10°C.
13. The water at 30°C is at the higher temperature.
14. a. Cup 6, containing water at 30°C, contains the most energy.

    b. The water is at a higher temperature.
    Also, water holds a greater amount of heat than oil does.
15. a. The heat would move from the water.

    b. The water is at a higher temperature.
16. a.

Note: The student should now complete the assignment for Section 3 in the Module 4 Assignment Booklet.

Section 4: Sources of Heat

By the end of this section students should be able to

- identify sources of heat
- identify advantages and disadvantages of heat sources
- compare the energy content of fuels
- compare the energy content of foods

Section 4: Activity 1

Note: Part A is optional, but students must do Part B.

Comments:

Although Part A is optional, it is suggested that students do attempt to complete Part A under the supervision of a learning facilitator. Students are often quite surprised at the amount of heat that is contained in a peanut and in a walnut.

Part A: Measuring Heat Content of Foods (Optional)

Caution

This activity is to be done under the supervision of the learning facilitator.

Observations

Answers will vary.

Questions to Answer

1. The food was burned. The heat of the flame caused the water to be heated.

2. They both contain energy.

3. The temperature of the water rises.

4. Answers will vary. Check with the results stated in the observations chart for the peanut. To obtain the answer the student needed to subtract the starting temperature of the water from the final temperature of the water.

5. Answers will vary, but should correspond with the information given in the student's observation chart.

6. a. Answers will vary.

   b. The temperature rise for the heated water will have been greater for this nut than for the other.

Part B: Interpreting Heat Content of Foods

7. chocolate milkshake 4950 J/g × 400 g = 1 980 000 J = 1980 kJ

   fried egg 7350 J/g × 46 g = 338 100 J = 338.1 kJ

   wiener 3200 J/g × 37 g = 118 400 J = 118.4 kJ

   peanut butter 24 750 J/g × 16 g = 396 000 J = 396.0 kJ

   banana 3850 J/g × 114 g = 438 900 J = 438.9 kJ

   apple pie (slice) 10 700 J/g × 158 g = 1 690 600 J = 1690.6 kJ

   chocolate bar 19 600 J/g × 30 g = 588 000 J = 588.0 kJ

8. greatest energy content chocolate milkshake
   apple pie
   chocolate bar
   banana
   peanut butter
   fried egg

   least energy content wiener

9. peanut butter

10. wiener

11. chocolate milkshake

12. wiener

13. a. the chocolate milkshake

    b. The energy content of one serving is very high.

14. a. You might consider the wieners.

    b. The wieners have a low energy content.

15. methane

16. coal

17. Fuels generally have a higher energy content.

Section 4: Activity 2

1. The temperature increased.

2. Answers will vary. It is likely that the temperature rise would be greater.

3. Answers will vary. The friction between the nail and the brick is greater if there is more pressure.

4. Answers will vary. The following answer is an example:
   If parts of a machine rub together without being oiled, they could wear out.

5. Answers will vary. The following answer is an example:
   When you strike a match, the friction of the match helps by making the match start to burn.

6. The temperature increased.

7. The particles in the paper clip move back and forth more quickly as a result of the bending.

8. The temperature increased.

9. The friction of the hammer against the wood caused the temperature to rise.

Section 4: Activity 3

1. Answers will vary. The following answers are examples:

   Foods

   - bread
   - potatoes
   - sugar

   Fuels

   - coal
   - oil
   - natural gas

2. - water power
   - natural gas
   - coal

3. Answers will vary. The following two answers are examples:

   - Electricity is used to heat a toaster.
   - Electricity is used in an electric kettle.

4. It is sometimes used because of its availability. Geothermal energy is used in areas where hot materials from inside the earth make their way to the surface (for example, in parts of Iceland, New Zealand, Italy, and the northwestern United States). Also, where it is available, it may be more economical to use geothermal energy than other sources of energy.

5. Answers will vary. Some of the changes that might be suggested include

   - having more south-facing windows
   - improving the insulation of the house
   - using solar collectors

Section 4: Follow-up Activities

Extra Help

1. Answers will vary. The following answers are examples:

   - Energy Source: wood (chemical energy)
     Method 1: Use a wood fire to heat a kettle of water.

   - Energy Source: electricity (electrical energy)
     Method 2: Use an electric kettle to heat the water.

   - Energy Source: natural gas (chemical energy)
     Method 3: Use a gas stove to heat a kettle of water.

2. Answers will vary. The following answers are examples.

   a. Method 1
   advantage: The wood fuel is available in many areas. You don't need very much special equipment.
   disadvantage: Using wood fuel may lead to the loss of forests. Wood is not as convenient to use as some other fuels.

   b. Method 2
   advantage: Electricity is very convenient to use.
   disadvantage: A source of electrical energy is needed. A way of bringing the electrical energy to where it is to be used is also needed.

   c. Method 3
   advantage: Natural gas is a convenient fuel to use.
   disadvantage: Natural gas stoves use up a valuable natural resource.

Enrichment

Caution

This activity is to be done under the supervision of the learning facilitator.

Observations

Answers will vary. The large candle will increase the temperature of the water more than the birthday candle.

Interpretations

1. 420 J of heat energy would be needed. e.g. $100\ g \times 4.2\ J/g = 420\ J$

2. Answers will vary. They must agree with the results in the student's observation chart. The following answers are examples.

   a. change in temperature for birthday candle 4°C

   b. change in temperature for large candle 8°C

3. Answers will vary according to student's answers given to question 2. For the examples given, the answers would be

   a. $420\ J/°C \times 4°C = 1680\ J$

   b. $420\ J/°C \times 8°C = 3360\ J$

4. Answers will vary, but will be half the results given for question 3. a. since the water in the investigation was heated for 2 minutes; e.g., $1680\ J \div 2 = 840\ J$.

5. Answers will vary, but will be half of the result given for question 3. b. since the water in the investigation was heated for 2 minutes; e.g., $3360\ J \div 2 = 1680\ J$.

6. You would need to determine the mass of the candle before and after burning. Then subtract to calculate the number of grams of the candle that burned. The number of joules is then divided by the number of grams.

Note:
1. The student should now complete the assignment for Section 4 in the Module 4 Assignment Booklet.
2. Check to see that all assignments have been completed and that all written work is done neatly in blue or black ink. Diagrams may be left in pencil.
3. The completed Assignment Booklet should now be submitted to the Alberta Distance Learning Centre for correction. The student can proceed with the next module while waiting for the return of the Assignment Booklet.

Module 5 – Micro-organisms and Food Supplies: Overview

The major emphasis of this module is on science, technology, and society. However, concepts involving the other two emphases regarding the general nature of science and the relationship between science and technology are also present.

Module 5 examines how food is kept safe for human use. Students are given background information regarding scientific and technological developments. They then look at how various technologies are used in food preparation and preservation.

Within Module 5 students learn about health problems that result from improper food preparation and handling. They become aware of various kinds of micro-organisms and where these micro-organisms live. They learn about how micro-organisms affect food and what can be done to keep food safe from micro-organisms. Students then use the information gained to consider various issues and as a basis for making knowledgeable decisions regarding the safe handling of food.

Section 1:
Food and Health Problems

Section 2:
There Are
Micro-organisms Everywhere

Section 3:
Making Decisions!

Section 4:
Food Technology

Section 5:
Safety Standards

Evaluation

The student's successful completion of all assignments will depend on practice obtained while doing the various activities. Many choices of activities have been provided so that students have some control over their own learning.

The following distribution of marks will determine the student's grading for this module.

ASSIGNMENT	VALUE
Section 1	0 Marks
Section 2	31 Marks
Section 3	21 Marks
Section 4	26 Marks
Section 5	22 Marks
TOTAL	100 Marks

Note: There is no assignment to be completed for Section 1.

Each module in Science 7 is worth 10% of the student's course mark. The final test, based on the learnings from all six modules, is worth 40% of the total final grading.

Materials Needed for Module 5

Comment:

In order to assist students effectively in their study of this course, it may be helpful to preview Module 5. This will give you an idea as to how the topics are developed; it will also give you an overview of the materials needed in the module. In some cases if the materials suggested are not readily available, the learning facilitator may be able to substitute suitable materials for the student, so that the activities can be completed successfully.

The materials needed for Module 5 and the activities in which they are to be used are as follows:

Section 1: Activity 4

Note: Students may choose to do either Part A or Part B.

Part A

- salt
- two slices of potato, about 1 cm thick
- two slices of apple, about 1 cm thick
- four jars or glasses to set the food into
- lids or plastic wrap
- labels or grease pencil
- measuring spoon

Part B

- a stove with an oven
- two or three apples
- knife
- cake cooling wire rack
- cookie sheet
- ascorbic acid
- cup of cold water
- measuring spoon
- bowl

Section 2: Activity 1

Part A

Note: Students may choose Part B, a videocassette pathway, or Part C, which does not require any materials.

- microscope
- lens tissue
- prepared slides of micro-organisms
  - typical bacillus
  - typical coccus
  - spirillium
  - yeast

Section 2: Activity 2

- tall glass jar (500 mL)
- ruler
- yeast
- measuring cup
- measuring spoon
- warm water
- 250 mL flour
- 10 mL sugar
- grease pencil
- large spoon
- large bowl

Section 3: Activity 1

- fruit
  - 1/2 orange or lemon
  - a few grapes
  - apple slices
- vegetables
  - thick potato slice
  - fresh green beans
  - zucchini or cucumber slices
- a slice of preservative-free bread
- 250 mL cottage cheese in its container
- 125 mL milk
- 10 mL of soil (not sterilized)
- two small jars with lids
- tape
- paper towels
- plastic wrap
- clear plastic bags
- cookie sheet or pan
- measuring spoon

Section 3: Activity 4

Part A

Note: Students may choose Part B, which does not require any materials.

- 1 L pasteurized milk (whole or 2%)
- 10 g milk powder
- 30 mL plain yogurt OR 5 g yogurt culture
- measuring spoon
- saucepan
- thermometer
- 4 or 5 very clean containers with lids
- spoon

Section 4: Activity 1

Note: The following materials are needed if students will be trying to preserve some sliced apples by canning them. The canning portion of this activity is optional, and if it is done, the learning facilitator or another adult must be present to supervise and assist the student.

- five or six apples
- knife
- cutting board
- spoon
- clean cloth
- tongs
- mason jar with lid
- a saucepan of about 2 L capacity
- a saucepan large enough for the jar to fit inside
- stove

Media (Optional)

The following video programs are suggested if the students are to use the optional media learning pathways in Module 5. You may wish to preview them before using.

Section 2: Activity 1

Part B

The Microscope and Its Incredible World (21 minutes)

Section 2: Activity 4

Microbeasts and Disease (first 10 minutes)

Section 3: Activity 6

Microbeasts and Disease (middle portion of program)

Section 4: Enrichment

Part A

Microbeasts and Disease (last portion of program)

Note: Videocassettes used in this course may be available from the Alberta Distance Learning Centre or call your local school authorities.

Section 1: Food and Health Problems

By the end of this section students should understand that

- health problems may result if food is not prepared, handled, or stored safely
- many years ago different societies developed ways to prevent food from making them ill
- they can help to decide what foods are safe to eat and how to keep them that way

Section 1: Activity 1

1. • viruses • bacteria

2. • warmth • presence of moisture • presence of oxygen (from air)

3. • washing hands after using the bathroom • keeping some foods in cold, dry places
   • not coughing or sneezng around food

Section 1: Activity 2

1. Packaging food in a box (shredded wheat) or storing in a covered container (parmesan cheese, dried peas) deprives micro-organisms of moisture.

2. Freezing (green beans and the bacon) deprives micro-organisms of warmth.

3. All of the packages shown keep micro-organisms from the food to some extent, but the canned food and bacon are completely cut off.

Section 1: Activity 3

1. The milk and potato chips can be left to get ready just before serving time.

2. The egg salad sandwiches and the fresh fruit salad with whipped cream may need to be prepared in the morning.

3. a. wrap and refrigerate
   b. leave them sealed in the package
   c. wrap and refrigerate
   d. place in a sealed container and refrigerate
   e. place in a sealed container and refrigerate

Section 1: Activity 4

Note: Students are to do either Part A or Part B, but they may do both parts if they wish.

Part A

Observations

Answers will vary. Check to see that the observations the student stated here are used as the basis for answering the questions which follow.

1. Answers will vary. A sample answer is given.
   A clear, runny liquid began to appear around the potato slices during the first day, becoming increasingly thick and murky the following day. Eventually the salt disappeared and the top of the potato turned brown.

2. Answers will vary. A sample answer is given.
   Some clear liquid appeared during the first day, but not as much as in the salted slices. After the next day, the liquid became murky and the potato became dull grey on top.

3. a. No. (Salting food helps but is not sufficient to prevent micro-organisms.)

b. Answers will vary. Students should note that the salted potato did not decay in the way the control set-up did, but that the food did spoil somewhat. To keep micro-organisms from the food it should also be dried.

Part B

4. Answers will vary. Students should note that if micro-organisms are allowed to infect the meat or fish, those eating it might become sick.

5. Answers will vary. Note that 3 to 6 hours is a normal range of time required.

6. The slices will discolour somewhat from their original pure white condition and will lose much of their volume.

7. Answers will vary. Students should note that there is less moisture for the micro-organisms to use.

Section 1: Follow-up Activities

Extra Help

1. A large number of answers could be given based on the Health Problems chart. Any two of the following answers are acceptable.

   - in the air
   - on objects
   - in soil
   - on poultry
   - in milk
   - in dairy products
   - on the hands
   - on some wild animals
   - in eggs

2. - in poultry
   - on eggs
   - in dairy products

3. Any two of the following example answers are acceptable.

   - by eating food with bacteria on it
   - by breathing in the bacteria
   - by touching the bacteria and then touching your mouth

4. You will become sick.

5. You might have come in contact with bacteria which you may then transfer to food or to other people.

6. a. Micro-organisms can grow but not very quickly because of the cold.
   b. Micro-organisms can get at the food from being exposed to the air and grow quite quickly.

7. a. This procedure can prevent micro-organisms from multiplying, but only if there are none in the food to start with.
   b. Micro-organisms can get at the food from being exposed to the air and grow quite quickly.

8. a. No.
   b. The moisture in the grapes provides a place where micro-organisms might grow.

9. The beef jerky does not need to be refrigerated. (The beef jerky does not support the growth of micro-organisms in the same way the beef does because it has been dried and salted to prevent their growth.)

Enrichment

1. a. and b. Answers will vary depending on the six foods the student selected for lunch. Check to see how reasonable the student's food selection is and as to whether the foods spoil easily or not.

   c. Answers will vary. Student answers should show evidence of critical thought and a realistic concern for their own safety.

Note: There is no assignment for Section 1. Students may go on to Section 2 at this point.

Section 2: There Are Micro-organisms Everywhere

When students have finished this section, they should be able to describe

- what some micro-organisms look like
- where some micro-organisms can be found
- what conditions are needed for micro-organisms to grow

Section 2: Activity 1

Note: Students are to do either Part A, Part B, or Part C.

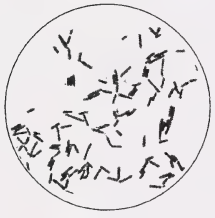
Part A

Comments:

Part A involves using a microscope to observe prepared slides of micro-organisms. Emphasize to students that a microscope is a valuable and delicate instrument. Special care is required when using a microscope. Be sure the student understands how to handle and take care of the particular model of microscope that they are using.

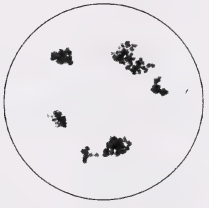
Observations

Learning facilitators should view slides to be used with this activity. Diagrams should show general features of materials viewed.



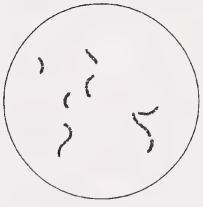
Typical Bacillus

overall shape: irregular (random spacing)
shape of each cell: rod shaped



Typical Coccus

overall shape: clumps
shape of each cell: rounded



Spirillum

overall shape: curves and spirals
shape of each cell: curved rods

Yeast

overall shape: irregular (random spacing)
shape of each cell: rounded (oval)

The yeast cells will appear much smaller than shown when viewed through student microscopes.

1. a. 100 times
   b. 400 times

2. The shape of the individual cells is most like the coccus form.

3. The bacillus cells were scattered and rod shaped. The coccus were in clumps and more rounded in shape.

4. A small part grows out from the main cell. This part breaks off and becomes a new cell.

5. yeast and coccus

6. The food is the material in which the micro-organisms live and it serves as their food as well.

Part B

Comments:

The videocassette *The Microscope and Its Incredible World* shows students how to use a microscope and what many small organisms and micro-organisms look like through a microscope.

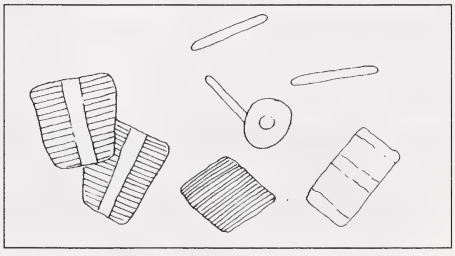
Students are to view the videocassette (about 21 minutes long) and then answer the following questions.

7. The microscope contains at least two lenses which are the main parts of the microscope.

8. 200 times

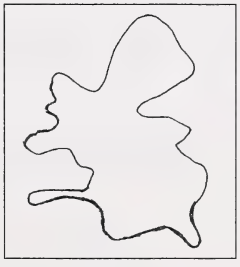
9. 3 Place your eye directly above the eyepiece.
   5 Use the fine focus knob to bring the specimen into focus.
   2 Rotate the nosepiece so that the objective with the lowest power is directly above the stage hole.
   1 Place the slide on the stage beneath the stage clips.
   4 Turn the coarse focus knob slowly until the specimen comes into rough focus.
   6 Change to a higher power objective.

10. Diatoms show a variety of shapes and sizes. Many show regular outlines with lines that go across the surface in rows. Some are rectangular, some are circular, and some are linear in shape.



11. b. Answers may vary with pond water sampled.

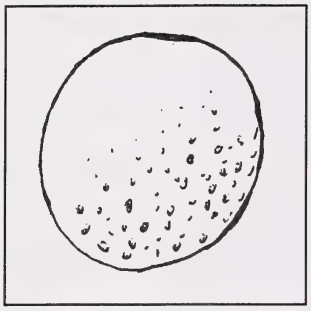
12. The shape of an Amoeba is an irregular curve. An Amoeba changes its shape as it moves.

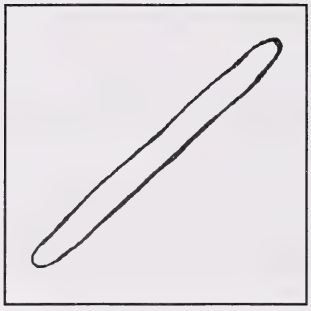


13. A Paramecium is slipper-shaped.

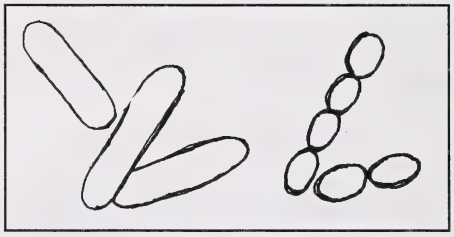
14. They are used to move the protozoan.

15.





16. Bacteria have many different shapes. The ones shown in the videocassette are mainly rod-shaped, sausage-shaped, or elliptical.



17. Without the microscope, people would not be able to see a tremendous variety of organisms that form a significant part of our world.

Part C

Comments:

Even though students may not have a microscope, they should become familiar with the proper use and care of a microscope before observing diagrams of micro-organisms. Questions 18 and 19 are based on information found on pages 368 to 370 of *Science Directions 7*.

18. The microscopes used in science classes are compound microscopes. Viewing is done through a series of lenses to improve magnification. There is a lens in the eyepiece and another one in the objective.

    To find out how many times larger than actual size an object appears when viewed through a microscope, multiply the power of the two lenses.

19. You should always start by focussing with the low-power objective lens.

Comments:

Students are to observe the photographs of micro-organisms and read the descriptions on pages 256 to 259 of *Science Directions 7* to answer questions 20 to 23.

20.

largest	fungi
	protozoa
	algae
	bacteria
smallest	viruses

Note the size, even within each type of micro-organisms, is highly variable, especially for colonial forms.

21. viruses, bacteria, some algae, protozoa

22. some algae, fungi

23. They cannot grow outside the cells of other living organisms. (Students may also indicate their small size.)

Section 2: Activity 2

Observations

Answers will vary. The level should rise during each time interval.

1. In the water, some small bubbles of gas formed. In the dough, the dough rose because of the bubbles formed by the yeast.

2. Answers will vary. Suitable answers might include lowering the temperature, decreasing the amount of available sugar, or decreasing the amount of available water.

3. The gas (carbon dioxide) formed during fermentation by the yeast causes the bread dough to rise.

Section 2: Activity 3

1. Answers will vary. The following are sample answers:

   - increase amount of yeast
   - increase amount of yeast food
   - increase amount of liquid

2. Answers will vary. The following are sample answers.

   - decrease amount of yeast
   - decrease amount of yeast food
   - decrease the temperature

3. a. Answers will vary.

   b. Answer should be consistent with what student stated for question 1 or 2, depending upon which variable they chose to test.

4. Materials used will vary according to the variable which the student is testing. Check the student's answer to question 5; then return to this question to see that the materials listed here are appropriate for testing the variable described.

5. Answers will vary. Students can use Activity 2 as a guide and compare their results in this activity to their results in Activity 2, or they can devise a new series of experiments. Whatever method the student described, it should effectively test the variable that was chosen in question 3. Check to see that the student keeps all variables the same except the one that is being tested in order to have a controlled experiment. For example, if the student chose to vary the amount of yeast, then all other variables such as amount of flour, type of liquid, temperature of water in the bowl, etc., should be kept the same while the effect of different amounts of yeast is being tested. Check to see that the materials listed in question 4 are appropriate for testing the variable described.

Comments:

You may wish to refer the student to page 352 of the textbook to read Controlled Experiments if the student doesn't have a clear understanding of how to design and do experiments.

6. Answers will vary. For a controlled experiment at least two parallel experiments (e.g.) treatment A and treatment B, are needed where one is the control and the other tests the effect of the variable that is changed. A sample chart follows.

Time	Height of Bread Dough	
	Treatment A	Treatment B
Start		
1/2 hour		
1 hour		
1 1/2 hours		
2 hours		
2 1/2 hours		

7. a. Answers will vary depending on which variable was chosen.

   b. In comparison to normal yeast multiplication observed in Activity 2, the yeast multiplied more quickly or more slowly depending on variable chosen.

Section 2: Activity 4 (Optional)

Comments:

This is an optional activity. If the choice is made not to watch the video program for this activity, or if the necessary videocassette is not available, the student may omit Activity 4 and move on to the Follow-up Activities.

The videocassette for this activity is called *Microbeasts and Disease*. The term *microbeasts* means micro-organisms. The program was made in England. Also, at times the sound track is hard to hear because of background noise. If the student has trouble understanding what is being said, the videocassette may be stopped and rewound so that it can be listened to again.

The student is to answer the following questions in full sentences. To do this, the videocassette may need to be stopped while answering the questions. The questions are based on the first 10 minutes of the video program. After the questions have been answered, the videocassette should be stopped. The rest of the video program will be watched in later sections of this module.

1. The tailor had some cloth brought down from London; something in the cloth carried the disease.

2. They stayed within their village. No one entered and no one left.

3. Usually milkmaids had suffered cowpox disease. Jenner's theory was that, having had cowpox, a person was somehow immune from smallpox.

4. He was trying to find the cause and cure for smallpox.

5. He performed his test on a young boy who had suffered neither disease. First he caused the boy to contract cowpox disease. Later, he could not give the boy smallpox by the same method.

6. Smallpox has been all but wiped out by Edward Jenner's vaccination process.

7. After about 1500X magnifications, micro-organisms were found on the tip of the pin.

8. Each micro-organism divides into two, and then each of these divide into two more.

9. a. $2 \times 2 \times 2 = 8$ micro-organisms
   b. $2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 = 512$ micro-organisms

10. a. The dishes are placed in a warm location.
    b. The warmth encourages the growth of the micro-organism.

11. The mould grows because the bread provides food and moisture.

Comments:

After the part on bread mould, the student should stop the videocassette. The rest of the videocassette will be watched in the next section of this module.

Section 2: Follow-up Activities

Extra Help

1. Micro-organism means a very small living thing.

2. They are too small to be seen with the naked eye; a microscope is necessary.

3. Most are unicellular (made up of single cells).

4. Answers will vary. Sample answers are given.

   - They can reproduce and grow.
   - They use the energy of the food that they live in.
   - Most micro-organisms have a cellular structure.

Enrichment

1. Answers will vary. The student's answers should show creative and critical thinking skills in recognizing that a successful scientist performs tests to prove or disprove his or her ideas but is always open to new ideas.

2. Answers will vary. The student's answers should reveal an understanding of the advantages (e.g., food-making and breaking down of wastes) and disadvantages (e.g., disease causing) of the existence of micro-organisms.

Note: The student should now complete the assignment for Section 2 in the Module 5 Assignment Booklet.

Section 3: Making Decisions!

Upon completion of this section, students should

- understand that micro-organisms obtain energy from food in a variety of ways
- understand that all micro-organisms need energy to be able to grow and multiply
- be able to describe some harmful effects of micro-organisms
- be able to describe some beneficial effects of micro-organisms
- be able to use knowledge of micro-organisms to make personal decisions about safe handling of food

Section 3: Activity 1

Comments:

In this activity students are going to examine foods for evidence of micro-organisms. They should use as many of the suggested foods as possible. Some may have been treated to prevent micro-organisms from growing on them. However, students will likely not see evidence of the treatment on the foods.

Under no circumstances are students to open the containers for a closer look at the food. There shouldn't be micro-organisms harmful to humans in the food, but there may be. Students must treat the food as potentially dangerous. If they are doing this activity at home, they should tell all family members about the potential danger of opening the containers. If there are very young children at home, the foods are to be kept in a place where the children cannot get at them. Upon completion of this activity, the student should put all the foods used into a large plastic bag, seal the bag, and put the bag into the garbage.

Observations

Answers will vary. Students should describe any changes in colour, texture, or shape, and they should note the presence of any growing materials that may be found on the foods.

Interpretations

1. Answers will vary according to the particular micro-organisms that establish themselves in the food. Student answers should focus on change of colour, texture, shape, and the presence of growing material that may be found on the food. The answers given here should be based on the descriptions stated in the observations chart.

2. Different types of bacteria feed on different foods and produce different symptoms.

3. a. milk with soil
   b. There was a greater amount of curdling and a stronger smell.
   c. The soil contains numerous micro-organisms.

4. a. All of the foods should show signs of decay.
   b. Answers will vary. Normally the reason for lack of evidence of decay is related to the presence of inhibitors in the food (either natural or artificial), or the lack of a suitable site for decay to establish itself.

5. • food source
   • moisture
   • warmth
   • darkness
   • presence of oxygen

Comments:

- Although many micro-organisms prefer dark conditions over bright conditions to grow in, this doesn't apply to all micro-organisms as some micro-organisms do well in light.

- Students may also indicate the presence of oxygen as another necessary condition. Credit should be given for the answer, but the marker might indicate to the student that some micro-organisms do not require oxygen.

Section 3: Activity 2

1. a. probably not
   b. Assuming the outside temperature is warm enough for a picnic, this warm temperature is ideal for micro-organism growth.

2. Answers will vary. Student answers should reveal an understanding that cooler temperatures would be better for preserving the milk.

3. They should be stored in the refrigerator. Only the ones that will be used soon should be put in a bowl.

4. Cool temperatures stop the action of micro-organisms.

Section 3: Activity 3

1. Answers will vary. Sample answers follow:

   a. Cheese is a solid, whereas milk is a liquid.
   b. The bean is a solid lump. The cocoa is a finely divided solid (a powder).
   c. The bean is a solid lump. The coffee is a finely divided solid (a powder).
   d. Beans and wheat are solids. Soya sauce is a liquid.
   e. Soybean milk is a liquid. Tofu is a semisolid (a gel).
   f. Grapes are a solid fruit with liquid inside. Wine is a liquid.

2. Answers will vary. The illustration on the right is a sample answer.

grapes containing natural sugar

↓

sugar plus yeast (single-celled fungi)

↓

fermentation

wine (alcohol)

Section 3: Activity 4

Note: Students are to do either Part A or Part B.

Part A

Caution

This activity should be done under the supervision of a parent or learning facilitator.

Comments:

Yogurt is a good example of a beneficial effect of micro-organisms. In this activity students are to follow the instructions given in the Module Booklet to make yogurt. Check to see that the student is following the instructions stated while making the yogurt.

1. This is the ideal temperature for growth of yogurt bacteria.
2. The bacteria is in the yogurt culture.
3. The substances produced by fermentation build up and produce a strong flavour.
4. A cooler temperature slows down the multiplication of the micro-organisms.
5. Changes in taste, appearance, and texture occurred as evidence.

Part B

Observations

The bacteria used to make yogurt must meet three conditions before they will multiply. In the following chart, list the conditions. Then describe how those conditions are met when making yogurt. (To get you started, one of the three conditions has been identified for you.)

Conditions	How the Conditions Are Met
• The bacteria must have food for growth.	Milk is the food source.
• The bacteria must be placed in the correct temperature for growth.	The temperature is kept to approximately 45°C.
• The bacteria must have access to enough water (moisture) for growth.	Milk contains large amounts of water.

6. a. no
   b. The action of the bacteria has been stopped but will be resumed when placed again in good conditions for growth.

Section 3: Activity 5

1.

Producers	Consumers	Decomposers
grass apple	Michael	mould bacteria

2. • soil • organic matter

3. They would accumulate and never become available for reuse.

4. They would diminish.

5. Answers will vary. Student answers should show an understanding of the grass plants (the producers) containing nutrients eaten and taken up by a consumer (e.g., cow) which in turn are eaten and taken up by another consumer, humans.

Section 3: Activity 6 (Optional)

Comments:

- This activity is optional. If students viewed the videocassette *Microbeasts and Disease* earlier in this module, they should continue their viewing to answer the following questions. If they have not been viewing this program, they should go to the Follow-up Activities.

- To answer the following questions, students should start the videocassette where they left off in Section 2 (about half-way through) and continue up to the end of the sneeze. The last part of the videocassette will be viewed in a later section.

1. They assist in digesting your food.

2. They assist in breaking down the cellulose in grass. **or**
   They assist in digestion of the cow's food.

3. They are used in the making of cheese and yogurt (to turn milk into cheese or yogurt).

4. Yeast is used to make beer.

5. It is left in large, warm tanks.

6. It happens within 24 hours.

7. It is used as fuel (as fuel for a generator).

8. They cause disease.

9. He invented an antiseptic spray which he used during operations to prevent the spread of disease.

10. She insisted on keeping things clean. **or**
    She insisted on proper hygiene.

11. Most students will indicate that micro-organisms can be spread through the air by sneezing, as this was the method shown in the videotape.

Section 3: Follow-up Activities

Extra Help

1. They use energy to make their own food, and for food gathering, growth, and reproduction.

2. They get their energy from food.

3. a. producer c. decomposer e. decomposer
   b. consumer d. producer

4. a. appearance, texture, and taste c. appearance and taste
   b. appearance and texture d. appearance, smell, texture, and taste

5. a. fermented c. spoiled
   b. fermented d. fermented

Enrichment

1. Curds are the thick part of the milk which separates from the watery part when milk sours or cheese is made.
   Whey is the watery part of the milk which separates from the curd when milk sours or cheese is made.

2. Curdling means to thicken.

3. The terms mild, medium, and sharp refer to the increasing hardness of the cheese. The cheese ripens as the bacteria works. The longer the bacteria works, the harder the cheese and the stronger the smell and flavour of the cheese.

4. Roquefort cheese is made from goats' milk and mould.

5. Hard cheese is produced as a result of a longer fermentation process than soft cheese.

Note: The student should now complete the assignment for Section 3 in the Module 5 Assignment Booklet.

Section 4: Food Technology

By the end of this section students should be able to

- describe the difference between processing and preserving food
- describe some technologies used in preserving and protecting food
- provide reasons, based on scientific knowledge about micro-organisms, for using food technologies
- identify alternative approaches to food processing and packaging
- describe several points of view when making a decision

Section 4: Activity 1

Comments:

- Part of this activity, entitled Preserving Apples, is optional and is to be done only by those students who have the proper materials available and a learning facilitator or another adult who will assist the student. This person should work with the student to ensure that all the steps stated in the Student Module Booklet are done safely.

- All students are to answer the questions under Questions to Answer. Those students who were unable to actually do the canning to preserve some sliced apples are still required to read the entire activity to enable them to answer the questions.

1. The core and the peel of the apple were separated.

2. The apples were sliced to about 0.5 cm thick.

3. a. They were killed by the high temperature used in cooking the apples.
   b. They were killed by the sterilization of the jar and lid.

4. Pieces of apple on the rim of the jar will interfere with the seal formed.

5. This allows the air above the apples in the jar to escape as it expands when the jar of apples is being boiled. Also, this gives the ring room to expand; otherwise, the ring will stick when the jar and ring cool.

6.

Science Knowledge	Canning Technology
Certain types of micro-organisms are killed when they are boiled for a period of time.	The jar of apples was placed in a saucepan of boiling water for 10 minutes.
Micro-organisms that spoil apples need oxygen to live.	The lid of the jar has a coating of rubber which forms a seal when pressed down. No air can be drawn in and a partial vacuum is formed.

Section 4: Activity 2

1. Much of the food eaten is transported great distances.

2. Answers will vary. The following are sample answers.

Food Preservation Method	Advantage	Disadvantage
Cooling	There is very little change to the taste and texture of the food.	Over time there is some spoilage. (There is a limit to how long food can be stored this way.)
Freezing	Growth of micro-organisms is stopped while the food is frozen.	Some foods do not freeze well. (The texture changes.)
Canning (Using Mason Jars)	Companies can preserve and package food on a large scale.	Glass can be broken during handling and transportation.
Canning (Using Metal Cans)	This will kill micro-organisms in food.	Soldered joints sometimes leave small gaps through which air and micro-organisms could enter.
Artificial Additives	This will kill micro-organisms in food.	Some people have allergic reactions to these artificial additivies.
Freeze Drying	The food becomes light-weight.	This is expensive to produce.
Irradiation	This will kill micro-organisms in food.	Long-term effects on human health are unknown.

Section 4: Activity 3

1. a. Answers will vary.

   b. Answers will vary, but the student's answers should exhibit an element of critical thinking regarding the various factors involved in decision making.

2. a. Drying: Moisture is removed from the food so that micro-organisms cannot multiply (as in the drying of apples).
   Advantage: This is an inexpensive process that can be done at home.
   Point of View Represented: Economic
   Disadvantage: Drying takes a long time to do and it requires great effort.
   Point of View Represented: Personal Preference

   b. Ultra High Temperature: Food is heated to a temperature high enough to kill all micro-organisms; then it is stored in air-tight containers.
   Advantage: Once micro-organisms have been killed, they cannot multiply.
   Point of View Represented: Scientific
   Disadvantage: This process changes the taste of food.
   Point of View Represented: Personal Preference

   c. Canning (Mason Jars): This is the process you used to process apples in Activity 1.
   Advantage: The glass jars cam be used again once the contents have been eaten.
   Point of View Represented: Environmental
   Disadvantage: Tests have shown that the high temperatures used destroy some vitamins and minerals.
   Point of View Represented: Scientific

   d. Irradiation: This is one of the newer food processing technologies in which food is sterilized by deadly gamma rays. The food is not radioactive once removed from the radiation.
   Advantage: Irradiated food can be shipped long distances without refrigeration.
   Point of View Represented: Economic
   Disadvantage: The long-term effects on human health are not known.
   Point of View Represented: Scientific

Section 4: Follow-up Activities

Extra Help

1. Answers will vary. The following are sample answers.

   - drying
   - salting

2. - freeze-drying
   - cooling

3. - aritificial additivies (or chemical additives)
   - canning using jars

Comment:

Students are to consider the six different points of view discussed in this section in order to make informed decisions when answering questions 4 to 9.

4. economic

5. environmental

6. aesthetic

7. scientific

8. personal preference

9. a. Answers will vary.
   b. Answers will vary. Student answers should show critical thinking skills regarding the various factors in decision making.

Enrichment

Note: Students are to do either Part A or Part B, but they may do both parts if they wish.

Part A

Comments:

If students viewed the videocassette *Microbeasts and Disease* earlier in this module, they may wish to continue their viewing in Part A. Questions 1 to 7 are based on the portion of the video program from where they left off in Section 3 (from after the sneeze) to the end of the program.

1. The food eaten by the students at a school dinner was first suspected.

2. It churns up the food. (It makes it into a broth.)

3. a. No.
   b. The school dinner was not responsible for the illness.

4. He had to make observations and gather information.

5. a. The milk supply was the next suspect.
   b. No dangerous micro-organisms were found.

6. a. The water supply was the third suspect.
   b. The water was shown to be contaminated.

7. Some form of water treatment such as boiling the water or using bottled water from outside the area could be used. Treatment of the water source would be another way to correct the problem.

Part B

Comment:

Answers will vary. Sample answers follow.

1. Regulation: All wieners shall be kept cool until time of cooking.
   Reason: Growth of micro-organisms is stopped under conditions of cool temperatures.

2. Regulation: Once cooked, wieners should be kept very hot until served.
   Reason: Growth of micro-organisms is stopped under conditions of high temperature.

3. Regulation: All utensils used in food preparation shall be sterilized.
   Reason: Micro-organisms on the cutlery from handling will be killed.

4. Regulation: The wieners should be covered both before cooking and after heating.
   Reason: Covering the wieners will prevent materials from falling on the food or flies from landing on it.

5. Regulation: Once heated, wieners should be consumed within that day.
   Reason: The longer the food is kept, the greater the likelihood of spoilage.

6. Regulation: All hot dogs should be handled with utensils, not the hands.
   Reason: Micro-organisms could be transferred to food by hand.

Note: The student should now complete the assignment for Section 4 in the Module 5 Assignment Booklet.

Section 5: Safety Standards

In this section students will learn about

- safety standards which are set for preparing and handling food
- some issues regarding the setting of appropriate safety standards
- problems in regulating and enforcing safety standards

Section 5: Activity 1

1. a. There are three levels of government.

   b. federal
   provincial
   municipal

2. a. federal
   b. provincial
   c. municipal
   d. federal
   e. provincial
   f. provincial
   g. federal

Section 5: Activity 2

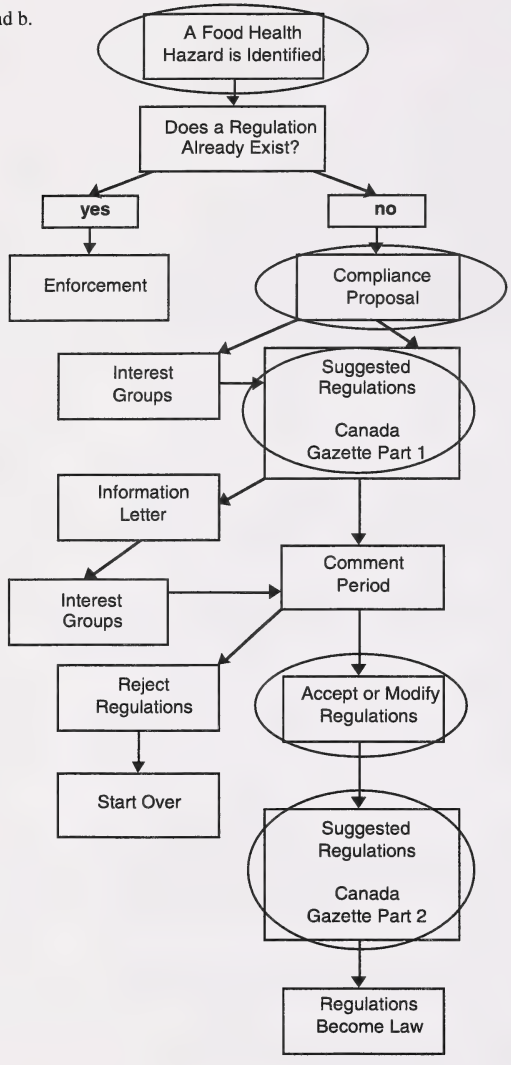
1. The government makes laws about safety standards for food to prevent problems with food before they cause illness and death.

2. There are many steps in the process.

3. It is a plan containing proposed regulations outlining how a potential hazard can be controlled so that the food product would be safe from any health hazard.

4. It is a group or association of people who share common interests or similar concerns for some public good.

5. a. and b.



c. Answers will vary. A sample answer follows.
Science can help to identify hazards and suggest ways to avoid them. Regulations can be made to ensure that known ways to avoid hazards are followed.

Section 5: Activity 3

1. This will help the investigator to pin down the original source of the problem.

2. This knowledge will help the investigator identify the time period in which a certain product was sold.

3. This knowledge will help the investigator know the extent of the effects of the food problem.

4. This information will allow the investigator to examine possible alternative sources of the problem.

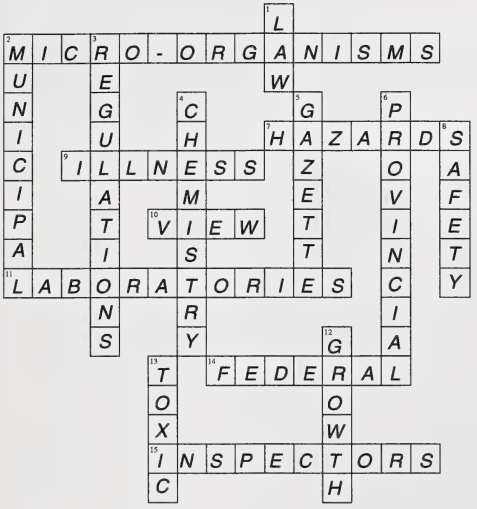
5. This information will let the investigator know if a sample of suspected food can be tested.

6. This information allows an understanding of how the suspected food was stored.

7. This knowledge will tell the investigator whether or not others may have been affected as well.

Section 5: Follow-up Activities

Extra Help



Enrichment

1. a. The greatest risk of food poisoning shown is botulism.

   b. Food should be thoroughly cooked before being sealed into jars. The containers should also be washed in very hot water and preserved food could be cooked again just before serving.

2. a. Salmonella might result from this situation.

   b. Meat should be refrigerated until it is cooked and then refrigerated again afterwards.

3. a. Answers will vary. Student answers should reveal critical thinking skills and an understanding of the type of food poisoning and its preventative measures.

   b. Answers will vary. Student answers should reveal a knowledge of science in regard to their chosen regulation.

Note: 1. The student should now complete the assignment for Section 5 in the Module 5 Assignment Booklet.

2. Check to see that all assignments have been completed and that all written work is done neatly in blue or black ink.

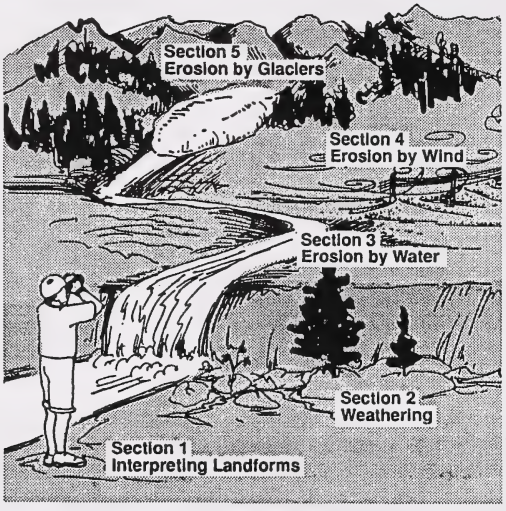
3. The completed Assignment Booklet should now be submitted to the Alberta Distance Learning Centre for correction. The student can proceed with the next module while waiting for the return of the Assignment Booklet.

Module 6 – Evidence of Erosion: Overview

The major emphasis of this module is on the nature of science. However, opportunities are also present to support the science and technology emphasis as well as the science, technology, and society aspects of the Science 7 program.

In this module students learn about how scientists study and explain changes to the Earth's surface brought about by the erosion, transport, and deposition of earth materials. Students develop an awareness and appreciation of how the Earth's surface gradually changes over long periods of time. They also learn how humans depend on the physical aspects of Earth, yet at the same time can affect the speed at which changes to the physical Earth occur.

In Module 6 students will experiment with models, such as stream tables, to test different variables to learn more about how changes can occur to the Earth's surface. By doing so they become more familiar with such scientific processes as observing and predicting, and learn how to make inferences about how the landscape has changed on the basis of evidence from data gathered.



Evaluation

The student's successful completion of all assignments will depend on practice obtained while doing the various activities. Many choices of activities have been provided so that students have some control over their own learning.

The following distribution of marks will determine the student's grading for this module.

Section 1 Assignment	**0 Marks**
Section 2 Assignment	**34 Marks**
Section 3 Assignment	**21 Marks**
Section 4 Assignment	**20 Marks**
Section 5 Assignment	**25 Marks**
TOTAL	**100 Marks**

Note: There is no assignment to be completed for Section 1.

Each module in Science 7 is worth 10% of the student's course mark. The final test, based on the learnings from all six modules, is worth 40% of the total final grading.

Materials Needed for Module 6

Comment:

For a complete overview of the materials needed for Module 6 and how the topics are developed, it may be helpful to preview the contents of Module 6. In some cases if the materials suggested are not readily available, the learning facilitator may be able to substitute suitable materials for the student so that the activities can be completed successfully.

The materials needed for Module 6 and the activities in which they are to be used are as follows:

Section 2: Activity 1

- plastic bottle with screw top
- plastic bag
- water
- freezer

Section 2: Activity 2

Note: Students may choose Part A, or Part B which does not require any materials.

Part A

- two uncoated iron nails
- glass of water
- two pieces of chalk
- bottle of soda pop

Section 3: Activity 1

Note: Students may choose either Part A or Part B.

Part A

- stream table
- water
- rock fragments of different sizes:
  - sand (very small)
  - gravel (small)
  - pebbles (medium)

Part B

- large transparent jar with lid
- water
- rock fragments of different sizes:
  - sand (very small)
  - fine gravel (small pieces of gravel)
  - pebbles (medium pieces of gravel)

Section 3: Activity 2

- transparent jar with lid
- water
- mixture of rock fragments:
  - sand
  - silt
  - small gravel

Section 3: Activity 4

- small jar or can
- water
- graduated cylinder or measuring cup
- soil samples:
  - dry gravel
  - dry sand
  - dry potting soil
  - dry garden soil
  - dry clay

Section 3: Activity 5

- shallow container that will hold water (minimum 30 × 20 × 5 cm)
- open-ended plastic or metal tubing, about 1 cm in diameter
- beaker or other convenient small container
- sand
- water

Section 3: Enrichment

- stream table or large plastic pail to catch the water and rock particles
- gold pan (or metal pie plate)
- lead shot, or another heavy substitute for gold
- gravel of mixed sizes
- sand
- water

Section 4: Activity 1

- drinking straws
- dry sand
- newspaper

Section 4: Activity 2

- hand-held hair dryer or small fan
- weights to hold cup in place
- soil samples
- plastic cup
- long, shallow box or tray (can be made by cutting down a large cardboard box to about 5 to 10 cm)

Section 5: Activity 3

- gravel
- several ice cubes
- several ice cubes made from water mixed with gravel
- several ice cubes made from water mixed with coarse sand
- plastic bucket
- piece of cardboard
- sand

Section 5: Extra Help

- modelling clay

Section 1: Interpreting Landforms

By the end of this section students should be able to

- recognize evidence of changes in the Earth's surface
- describe some features that result from changes in the Earth's surface
- understand some of the effects of these changes if they occur over a very long period of time
- understand that scientific knowledge builds up and changes over time.

Section 1: Activity 1

Comments:

For this activity students need to examine three photographs in their textbook. For each photograph they should

- describe their observations
- infer the changes they think have occurred
- explain what they think caused the change

1. a. Answers will vary. Hoodoos such as this one are tall shapes made of rock that stand separately from the rocks around them. Hoodoos usually have a cap rock on top. The rock is in layers.

   b. Answers will vary. Students may suggest wind or water erosion as being factors in the formation of hoodoos; water erosion is generally the main factor.

2. a. The water flows over the falls and between the rocks on either side.

   b. Answers will vary. The water is pulled down by the force of gravity. The waterfall wears away rocks on the bottom and sides of the falls.

3. a. Snow is sliding down the mountainside.

   b. Answers will vary. The weight of the thick layers of snow causes the snow to break free and slide down the mountain. Sometimes there is a trigger event that sets off the slide, such as a loud noise or the movement of a rock or an animal. Avalanches usually occur after there has been repeated partial melting and refreezing of the snow.

Section 1: Activity 2

1. She wanted to explain the changes she saw in the park by the school.

2. • inference one – Joanne thought that the paths were made by students.
   • inference two – Joanne thought that the rain deepened the paths.

3. • inference one – She observed that the grass was worn where people walked most often.
   • inference two – She observed the water running down the paths and the paths getting deeper.

4. The paths might become deeper.

Answers for questions 5 and 6 will vary. The following are possible answers.

5. • the wearing away of a river valley
   • small gullies in a field getting larger after repeated rainfalls
   • the wearing down of a mountaintop
   • topsoil blowing in the wind

6. • an avalanche
   • a landslide
   • an earthquake

Section 1: Follow-up Activities

Extra Help

Note: Students may do either Part A or Part B, or they may do both Part A and Part B.

Part A

1. a. Type of Change (sudden or slow): sudden
Explanation: The movements described are powerful ones that occur over a short period of time. Earthquakes are usually over in a matter of minutes.

   b. Type of Change (sudden or slow): sudden
Explanation: The eruption occurred so quickly there was no time for the people to escape.

   c. Type of Change (sudden or slow): slow
Explanation: A change of that distance would be so slow that you would not notice the change if you watched for only a few hours or days.

   d. Type of Change (sudden or slow): sudden
Explanation: The island must have appeared very quickly if after two years there were already plants growing on it.

   e. Type of Change (sudden or slow): slow
Explanation: The river continues to follow much the same course from year to year. The riverbanks have not changed substantially since the bridges were built.

   f. Type of Change (sudden or slow): sudden or slow
Explanation: Answers will vary. The changes could be interpreted either as fast or slow.
   - Sudden: Eruptions cause large quantities of materials to flow.
   - Slow: The eruptions occur over a long period of time, each one building up the land mass a little more.

Part B

2. a. Answers will vary. The interpretation of each example should be similar to those given in previous examples. Two sample answers follow.

   b. Sample Answer: A set of steps in an old building has hollows in the middle of each step where people place their feet.
Type of Change: slow
Explanation: The steps have been worn down slowly over a number of years.

   c. Sample Answer: A bank by a river valley has caved in.
Type of Change: sudden
Explanation: The side of the river bank gave away and slid down in just a few seconds. **or**
One day the bank was normal and the next it had caved in.

Enrichment

1. a. The more likely inference is B.
Explanation: You can observe that people usually walk on the middle of the step.

   Additional observations or tests you would like to make to check your inference: Check the hardness of the steps near the middle and near the edges.

b. The more likely inference is B as it is the most correct response. Inference A could also be accepted, provided that the explanation is reasonable.

Explanation: It is reasonable to expect that B would be correct if the student is aware that most of Alberta was once covered by glaciers and that there are glaciers in the area even to this day.

Additional observations or tests you would like to make to check your inference:
Answers will vary. Sample answers:

- One could look to see if there are any signs that glaciers have cut the valley (e.g. glacial grooves).
- One could look at the shape of valleys cut by glaciers and rivers and see which one this valley is most similar to.

c. Both of these inferences are reasonable, though A is the more likely of the two.
Explanation: Inferences A and B both provide an explanation for why the dandelions are found in only a few places.

Additional observations or tests you would like to make to check your inference: To have a better idea of what is happening, it would help to observe a path such as this one over a number of years to see if more dandelions appear by forcing their way through. It would also be helpful to see if a dandelion can grow through asphalt where at the start there is no opening.

d. The more likely inference is A.
Explanation: Answers will vary. Sample answer: When water reaches a bend in the river, it is guided around by the outside bank resulting in the formation of a steep bank. The inside bank is a gradual slope with a relatively low flat area just above the stream.

Additional observations you would like to make to check your inference: Check the softness of the materials in the two banks of the river to see if the material is harder on one side than the other.

Note: There is no assignment for Section 1. Students may go on to Section 2 at this point.

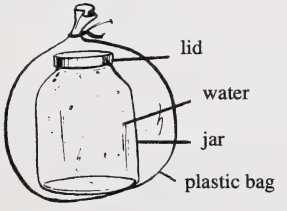
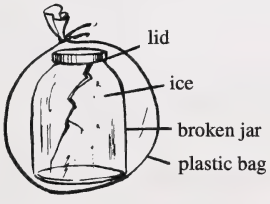
Section 2: Weathering

By the end of this section students should be able to

- explain what is meant by the term weathering
- recognize examples of weathering
- describe mechanical, biological, and chemical weathering
- identify variables that affect how fast something weathers

Section 2: Activity 1

Observations

Before Freezing	After Freezing
	

Comments:

This demonstration of what water does when it freezes should help students understand what could happen to rock. The plastic container represents rocks with cracks in them. Conditions in a freezer represent a cold night when water freezes.

1. If there were cracks in a rock, water could get into the cracks. If the water were to freeze, the water would push the pieces of rock apart.

2. Only a small amount of water will fit in a crack between two rocks, so the splitting only takes place a little bit at a time.

3. As the water freezes, it will expand and the container may break.

4. a. Cracks begin to form in the rock.

   b. This is caused by repeated heating and cooling of the rock, which causes expansion and contraction over and over again.

   c. Water gets into the cracks and the cracks open wider.

   d. This is caused by water freezing in the cracks during cold nights or during winters.

5. The first part of the explanation is needed to tell how the cracks get started.

6. a. Answers will vary. Cracks can be seen in the rock. Also, one can see different lichens that are growing on the rock.

   b. Answers will vary.
   Sample answer: Check to see if the cracks go all the way through the rock.

Section 2: Activity 2

Note: Students are to do either Part A or Part B.

Part A

1. The nail becomes covered with a dull reddish-brown layer.

2. It feels softer. (It can be scraped off easily.)

3. Answers will vary. The colour is different and the hardness is different.

4. The rust is more easily broken into smaller pieces.

5. a. The chalk gradually comes apart and forms a little pile in the bottom of the bottle.
   b. It is an example of chemical weathering.
   c. There is a chemical that causes the change (soda pop). **or** The original material is changed into another material.

Part B

6. a. Rust is softer.
   b. It rubs off on your fingers.

7. The colour is different and the hardness is different.

8. The rust is more likely to be broken into smaller pieces.

9. a. It is an example of chemical weathering.

b. The original material is changed into another material.

Section 2: Activity 3

1. Materials that are affected by these gases will be affected more strongly and more quickly.

2. Answers will vary. Scientists could compare the changes that take place in areas where there is very little emission of gases that cause acid rain, with changes that take place where there are large quantities of these gases.

3. a. Yes.
   b. Answers will vary. The observations show that the changes take place much more quickly in areas where there are many automobiles and other sources of air pollution.

4. Answers will vary. The explanation is not a scientific one because it cannot be tested. Science deals with what we can see and observe for ourselves and it must be testable.

Section 2: Activity 4

Note: Students are to do either Part A or Part B.

Part A

1. a. Answers will vary. Sample answer: A rock is found with some cracks in it.
   b. There are roots in the cracks.

2. a. Sample answer: A rock is found with some lichen growing on it.
   b. The rock is very dull-looking on the outside.

3. a. Sample answer: Some rocks were found at the front of a ground squirrel hole.
   b. Answers will vary. The rocks have been brought up by the squirrel. They do not appear to have gotten there by themselves.

Part B

4. Answers will vary. Sample answer: splitting apart of rocks by heating and cooling

5. One example is the wearing down of rocks by acid rain.

6. An example of biological weathering is the splitting apart of rocks by roots.

7. Answers will vary. Biological weathering involves the actions of living things.

8. Answers will vary. All cause the breakdown of rock materials.

9. Answers will vary. Many living things are found in rock and soil. Living things help change rock into soil. The minerals in the rock and soil provide nutrients to plants and animals.

Section 2: Activity 5

1. Answers will vary. The change is caused by chemical weathering, which results from the exposure of the penny to the air and to the materials on people's hands.

2. The sidewalks may have been affected by repeated heating and cooling and by the repeated freezing and thawing of water in cracks and under the sidewalk.

3. The copper may be changed by combining with materials in the air, including pollutants.

4. Answers will vary. The crack may have been originally started by heating and cooling, then enlarged by water and enlarged further by plant roots.

Section 2: Follow-up Activities

Extra Help

Note: Students may do either Part A or Part B, or they may do both Part A and Part B.

Part A

Answers will vary. Students should show evidence of creativity as well as an understanding of the items listed.

- biological weathering
- calcium carbonate
- carbon dioxide
- chemical weathering
- contract
- expand
- ice wedging
- mechanical weathering
- temperature

Part B

1. The process of rocks being broken down into smaller pieces is called **weathering**.

2. **Biological** weathering involves the action of living things.

3. During **chemical** weathering solids change into different materials.

4. The weak acid that forms when rain mixes with **carbon dioxide** is called **carbonic** acid.

5. When solids are cooled, they **contract**.

6. Cracks can form in rocks during changes in **temperature**.

7. Water will **expand** when it freezes.

8. **Limestone** and **marble** are types of rock that are affected by chemical weathering.

9. a.
   - animals
   - calcium carbonate
   - ice wedging
   - mechanical
   - plants
   - rock
   - soil

   b. Answers will vary. Sentences should contain any three of the words in (a).

Enrichment

1. The cold weather may have caused some of the rocks on the outside of the mountain to contract. It may also have caused some water to freeze in the cracks, causing rocks to split apart and break loose.

2. Answers will vary. Evidence of cracks in the rock might help show what happened.

3. The point to be made here is that the water in the soil may freeze on cold nights and expand as it freezes, breaking the planters.

Note: The student should now complete the assignment for Section 2 in the Module 6 Assignment Booklet.

Section 3: Erosion by Water

By the end of this section students should be able to

- recognize evidence of water erosion
- describe and classify sediments
- explain why river courses change
- explain why shorelines change
- describe how a river ages
- compare porosity of soil samples

Section 3: Activity 1

Note: Students are to do either Part A or Part B.

Part A

Comments:

As the learning facilitator, your assistance in helping the student set up the stream table will be required. If a stream table is not available, you may assist students with doing Part B.

Observations

Answers will vary. The following are example answers.

Flow of Water	Effect on Rock Fragments
dripping	Some sand grains are moved when the water drops hit them.
gentle flow	Some of the sand grains are carried down the slope.
medium speed	The sand and some of the small pieces of gravel are carried down the slope.

1. • sand — There was some movement of the sand.
   • gravel — There was no movement of the gravel.
   • pebbles — There was no movement of the pebbles.

2. • sand — There was movement of the sand downslope.
   • gravel — There was some movement of the gravel downslope.
   • pebbles — There was little or no movement of the pebbles.

3. • sand — The sand would move much more quickly.
   • gravel — The gravel would move more quickly.
   • pebbles — The pebbles would begin to move.

4. Observe how much of each kind of material is carried when the slope of the stream table is not very steep. Then change the slope and observe again to see how much of each type of material is carried.

Part B

Observations

Answers will vary. The following are example answers.

Speed of Water	Effect on Rock Fragments
very slow	– some slight movement of sand grains – no movement of gravel and pebbles
slow	– movement of sand grains – slight movement of pebbles – no movement of gravel
medium speed	– sand grains move more quickly – some movement of gravel – very little movement of pebbles

5. • sand — There was some movement of the sand.
   • fine gravel — There was very little movement of the fine gravel.
   • pebbles — There was no movement of the pebbles.

6. • sand — Movement of sand became more noticeable and more rapid.
   • fine gravel — There was some movement of the fine gravel.
   • pebbles — There was slight movement of the pebbles.

7. • sand — There would be rapid movement of the sand.
   • fine gravel — There would be more noticeable movement of the fine gravel.
   • pebbles — The pebbles would move along with the other materials.

8. • Stream A would likely cause some movement of sand, fine gravel, and pebbles. The movement of sand would be quite rapid.
   • Stream B would have very little movement of materials, mainly a very gradual movement of sand grains.

Section 3: Activity 2

1. a. They settle mainly near the bottom.
   b. They stop moving most quickly. (They are also the heaviest pieces.)

2. a. They settle mainly near the top.
   b. They do not stop moving as quickly and they do not settle out as fast because they are smaller and lighter.

3. first to settle — clay
   silt
   sand
   fine gravel
   last to settle — pebbles

4. a. Yes. Pebbles are found where they are laid down by rivers. Pebbles are smoothed and rounded as they rub against each other in the stream bed.

b. Yes or No. The grass and bushes could be growing on soil and sediments laid down by the river. They may also have been deposited in another way.

c. Yes. This is the shape of a young river valley.

d. Yes. This is a place that once was a part of a river (an oxbow lake).

e. No. Rivers cannot move material this size.

5. One might expect to find a variety of materials carried by rivers, including gravel, sand, silt, and clay. The smaller sized materials tend to be carried further out.

Section 3: Activity 3

Answers will vary.

Shoreline movement involves the movement of sediments from one location to another, caused by the action of currents. The action of waves can help break down the shoreline in one area and can also serve to help wash up the materials on another shore.

The two main processes involved are erosion, which is the process by which shoreline materials are broken down and picked up by the water, and deposition, which is the process in which the materials settle out of the water, usually in a place different from where they started.

Section 3: Activity 4

Comments:

Dry clay is often difficult to obtain as a soil since water makes it stick together in hard lumps. Collect the clay beforehand and allow it to dry. Then smash the lumps with a hammer before using the clay in this investigation.

Observations

Answers will vary. Usually the dry clay will absorb the least water, since there are only small spaces between the fine particles of clay. Gravel should hold the most water as larger particle sizes have larger spaces between them.

1. Answers will vary. Answers should be consistent with the results given in the Observations chart. Gravel should have the highest porosity and clay the lowest porosity.

2. a. Usually water will flow quickest through the gravel.

   b. Generally, there is a lot of space between pieces of gravel.

3. a. Answers will vary. Students will likely predict a result halfway between the two results obtained in the Observations chart, but the result will probably be different than predicted.

   b. The result will be less than for sand or gravel.

   c. The sand filled some of the spaces between pieces of gravel.

4. a. Most likely the clay will have the most runoff.

   b. The clay would likely be least able to absorb all of the water.

5. a. Most likely the gravel would contain the most ground water.

   b. There are more large spaces in the gravel than for other materials.

Section 3: Activity 5

Comments:

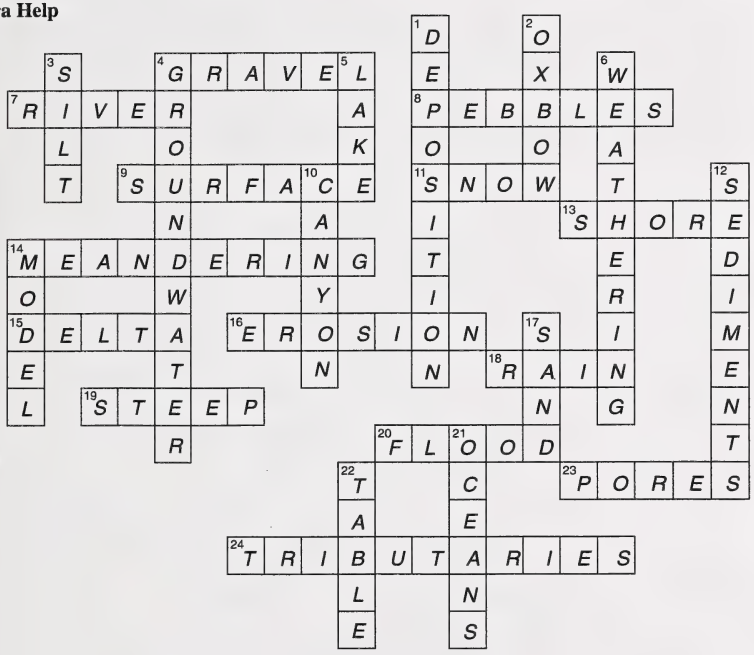
- Large baking trays may work well as the container to hold the sand and water. However, if students are finding that baking trays are not deep enough, then they may wish to try a baby's bathtub to see if it works better.
- Clean, course sand works best for this investigation as it allows water to flow quickly through it.

1. It went directly into the sand, filling in the spaces between the particles. The excess water settles at the bottom of the container and then begins to accumulate.
2. Answers will vary. If the sand used is not very clean, the deeper hole or well most likely showed water first since it is closest to the water source. However, if the sand that was used was clean (that is, it didn't have finer materials filling in the spaces between the particles), then the lowest depression (the lake) likely showed the water first.
3. Answers will vary. Water would most likely have appeared next in the "lake" or "slough," if the student said water had appeared first in the deep well in the answer to question 2.
4. Most likely the water appeared last in the shallow well.
5. Some of the water became runoff, but most went into the ground. It filled the wells, the lake, the slough, and the stream.
6. It travelled through the ground. Groundwater collects underground and raises the water table. The sloughs and streams are depressions in the ground. The water table meets the surface here.
7. The water table had dropped during the summer.
8. It went dry.
9. The water appears and disappears as the water table rises and falls.

10. Answers will vary. Models help us gain ideas about how the real world works. Models can help us understand what we see. Often they are useful in predicting what will happen as conditions change.

Section 3: Follow-up Activities

Extra Help



Enrichment

Comments:

For this activity students are to follow the instructions for Activity 6-6 which is described on page 313 of *Science Directions 7*. Leadshot was suggested as the substitute for gold. Another substitute that can be used is small fishing weights. These may be cut with scissors to make "gold nuggets" of various sizes. After completing steps 1 to 5 given under the Procedure, students are to make the necessary interpretations to answer some questions.

1. The "gold" is heavier and tends to settle in the bottom of the pan.

2. Gravity pulls particles to the bottom of moving water.

3. The force of the moving water keeps particles from settling out. (Some students might mention that lighter particles are more buoyant than heavier particles.)

4. The lighter substances are carried by the water and the heavier substances settle out.

5. The larger the sediments, the faster the stream was; the smaller the sediments, the slower the stream was.

Note: The student should now complete the assignment for Section 3 in the Module 6 Assignment Booklet.

Section 4: Erosion by Wind

By the end of this section students should be able to

- identify the features that result from wind erosion
- understand how wind erosion affects Alberta and how it can be controlled

Section 4: Activity 1

Observations

Answers will vary, but should be similar to those shown.

Before Blowing Dry Sand	After Blowing Dry Sand
Before Blowing Wet Sand	**After Blowing Wet Sand**
	(little or no change)

1. • the speed of the wind
   • the dryness of the soil

2. Answers will vary. Likely the dune will be moved downwind.

3. Some of the soil is likely to be deposited on the downwind (leeward) side of the obstacle, but very little, if any, on the upwind (windward) side.

Section 4: Activity 2

Comments:

If it is wintertime and soil particles of different sizes such as sand and garden soil aren't readily available, students can try using other easily available materials, such as a mixture of uncooked rice and other cereal grains, to represent the soil samples. To help speed the cleanup after the investigation students can place open sheets of newspaper on the area where this investigation is to be done.

Observations

Answers will vary. When the blower is turned on, it is likely that some of the soil materials will be moved, especially if they are dry. Some of the finer material and organic matter are likely to be moved first and also the farthest.

Answers will vary. When the obstacle is placed in the path of the wind made by the blower, the material carried along by the wind is largely deposited on the downwind side of the obstacle.

1. This usually depends on the size of the particles and also whether the particles are mineral material or some form of organic material.

2. Likely the movement would have been greater. More material would have moved and it would have been transported a greater distance.

3. Likely the materials would not have moved as far.

4. The cup caused an area where the wind was blocked. In this area, the material could fall and stay without being blown away again.

5. Trees would help by creating wind blocks, or at least they would slow down the wind in the area near them.

Comments:

There are no Follow-up Activities for this section.

Note: The student should now complete the assignment for Section 4 in the Module 6 Assignment Booklet.

Section 5: Erosion by Glaciers

By the end of this section students should be able to

- describe how glaciers develop
- describe how glaciers move
- identify the range and location of glaciers, past and present
- infer erosion by glaciers from landscape features

Section 5: Activity 1

1. The climate would need to become colder and/or snowfall would need to increase.

2. They are both formed from snow that builds up into thick layers of ice. They would both move due to gravity and pressure.

3. Continental glaciers have very little movement, whereas valley glaciers move downslope.

4. They are called this because they gradually move downslope, the way a river would.

5. The movement of glaciers is so slow that it often is not directly observed. Also, the front of the glacier may seem to stay in one place as the melting keeps pace with the advance of the glacier.

Section 5: Activity 2

Comments:

Students are to examine the illustration on the bottom of pages 334 and 335 of the textbook to answer the questions in this activity.

1. a. The two centre pictures show a stationary glacier.

   b. The weather must be neither very warm nor very cold. Over time the snow falling must equal that melting.

2. a. The two pictures at the left show an advancing glacier.

   b. The weather must be fairly cool or cold. Snowfall must exceed the amount melting.

3. a. The two pictures at the right show a retreating glacier.

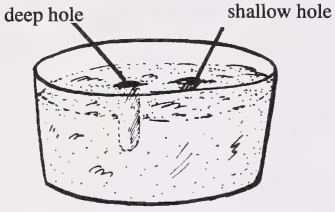
b. The weather must be fairly warm or hot. The amount of ice melting must be greater than the snowfall accumulating.

Section 5: Activity 3

Comments:

- In additon to ordinary ice cubes, students will need to prepare some ice cubes made from water mixed with coarse sand, and some made from water mixed with gravel. These should be prepared beforehand so that they are ready when the student is doing this activity.
- Students may use diagrams as part of their description of what they observed.

Observations

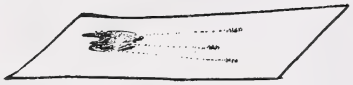


For the ice cube that was buried, a fairly deep hole was formed. For the ice cube that was pressed into the sand, a shallow hole was formed.

Clear Ice Cube

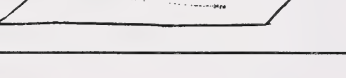
The only effect of the ice cube was to make the cardboard a bit wet.

Ice Cube with Sand Frozen in It



The sand made small scratches in the cardboard.

Ice Cube with Gravel Frozen in It



The gravel made some fairly deep scratches in the cardboard.

1. The moving ice with the sand and gravel inside simulated making striations.

2. The ice cubes left to melt in the sand simulated making kettle lakes.

3. a. The scratches (striations) show the direction of movement.

   b. The lines go in the same direction as the movement.

4. Answers will vary. River erosion can cause the movement of materials from one place to another.

5. Glaciers can move larger materials.

6. Glacial movements pushed the boulders to their present location. Then the glaciers melted back from where they once were.

Section 5: Follow-up Activities

Extra Help

1. An advancing glacier can push rocks at its front as well as carry rocks on top, inside, and under the glacier.

2. The glacier is moving downslope even as the front of the glacier is retreating. Materials can be carried on, in, or under the glacier.

3. Gravity moves the glacier down a valley.

4. If the weight was sufficient, the modelling clay spread out as it was flattened by the weight.

5. If there were not enough snow to keep pace with the yearly rate of melting, the glacier would stop spreading.

6.
- drumlins
- erratics
- kettle lakes
- U-shaped valleys
- moraines
- rough-edged pebbles

Enrichment

Note: Students may do either Part A or Part B, or they may do both Part A and Part B.

Part A: Researching Glacial Features

A cirque is a rounded, bowl-shaped valley formed on the slope of a mountain by a mountain glacier.

An esker is a winding ridge of sediment (sand, gravel, and so on) believed to have been deposited by meltwater streams flowing under retreating Ice Age glaciers.

Part B: Researching a Part of Alberta Not Covered by Glaciers During the Last Ice Age

Answers will vary. The main idea students should develop is that the life forms that existed before glaciation were for the most part displaced from Alberta, except in the Cypress Hills area.

Note:
1. The student should now complete the assignment for Section 5 in the Module 6 Assignment Booklet.
2. Check to see that all the assignments have been completed and that all written work is done neatly in blue or black ink. Diagrams may be left in pencil.
3. The completed Assignment Booklet should now be submitted to the Alberta Distance Learning Centre for correction.
4. The student should be reviewing all previously completed modules in preparation for the final test.

COURSE SURVEY FOR SCIENCE 7

After you have completed the assignments in this course, please fill out this questionnaire and mail it to the address given on the last page. This course is designed in a new distance learning format, so we are interested in your responses. Your constructive comments will be greatly appreciated, as future course revisions can then incorporate any necessary improvements.

Name _____ Age ❑ under 19 ❑ 19 to 40 ❑ over 40

Address _____ File No. _____

_____ Date _____

_____

Design

1. This course contains a series of Student Module Booklets. Do you like the idea of separate booklets?

_____

_____

2. Have you ever enrolled in a correspondence or distance learning course that arrived as one large volume?

❑ Yes ❑ No If yes, which style do you prefer?

_____

_____

3. The Student Module Booklets contain a variety of self-assessed activities. Did you find it helpful to be able to check your work and have immediate feedback?

❑ Yes ❑ No If yes, explain.

_____

_____

4. Were the questions and directions easy to understand?

❑ Yes ❑ No If no, explain.

_____

_____

5. Each section contains follow-up activities. Which type of follow-up activity did you choose?

   ❑ mainly extra help
   ❑ mainly enrichment
   ❑ a variety
   ❑ none

   Did you find these activities beneficial?

   ❑ Yes ❑ No If no, explain.

   _____

   _____

6. Did you understand what was expected in the Assignment Booklets?

   ❑ Yes ❑ No If no, explain.

   _____

   _____

7. The course materials were designed to be completed by students working independently at a distance. Were you always aware of what you had to do?

   ❑ Yes ❑ No If no, provide details.

   _____

   _____

8. This distance learning course may include an assortment of drawings, photographs, and charts.

   a. Did you find the visuals in this course helpful?

      ❑ Yes ❑ No Comment on the lines below.

      _____

      _____

   b. Did you find the variety of visuals in this course motivating?

      ❑ Yes ❑ No Comment on the lines below.

      _____

      _____

9. Suggestions for audiocassette, videocassette, and computer activities may have been included in the course. Did you complete these media activities?

❑ Yes ❑ No Comment on the lines below.

_____

_____

Only students enrolled in a Junior High course need to complete the following question.

10. The Student Module Booklet may have directed you to work with your learning facilitator. How well did you work as a team?

Student's comments: _____

_____

_____

_____

Learning Facilitator's comments: _____

_____

_____

_____

Course Content

1. Was enough detailed information provided to help you learn the expected skills and ojectives?

❑ Yes ❑ No Comment on the lines below.

_____

_____

2. Did you find the work load reasonable?

❑ Yes ❑ No If no, explain.

_____

_____

3. Did you have any difficulty with the reading level?

❑ Yes ❑ No Please comment.

_____

_____

4. How would you assess your general reading level?

❑ poor reader ❑ average reader ❑ good reader

5. Was the material presented clearly and with sufficient depth?

❑ Yes ❑ No If no, explain.

_____

_____

General

1. What did you like least about the course?

_____

_____

2. What did you like most about the course?

_____

_____

Additional Comments

_____

_____

_____

_____

_____

_____

_____

Only students enrolled with the Alberta Distance Learning Centre need to complete the remaining questions.

1. Did you contact the Alberta Distance Learning Centre for help or information while doing your course?

   ❑ Yes ❑ No If yes, approximately how many times? _____

   Did you find the staff helpful?

   ❑ Yes ❑ No If no, explain.

   _____

   _____

2. Were you able to fax any of your assignment response pages?

   ❑ Yes ❑ No If yes, comment on the value of being able to do this.

   _____

   _____

3. If you mailed your assignment response pages, how long did it take for their return?

   _____

   _____

4. Was the feedback you received from your correspondence or distance learning teacher helpful?

   ❑ Yes ❑ No Please comment.

   _____

   _____

   _____

   _____

Thanks for taking the time to complete this questionnaire. Your feedback is important to us. Please return this questionnaire to the address on the right.

If you are enrolled at the Alberta Distance Learning Centre and have been mailing your Assignment Booklets to ADLC, you may return this questionnaire with the final Assignment Booklet in the course.

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Learning Technologies Branch
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Science 7

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